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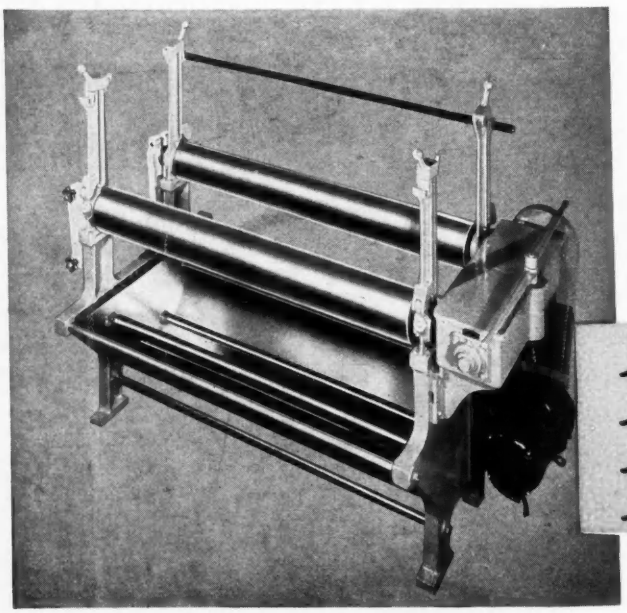

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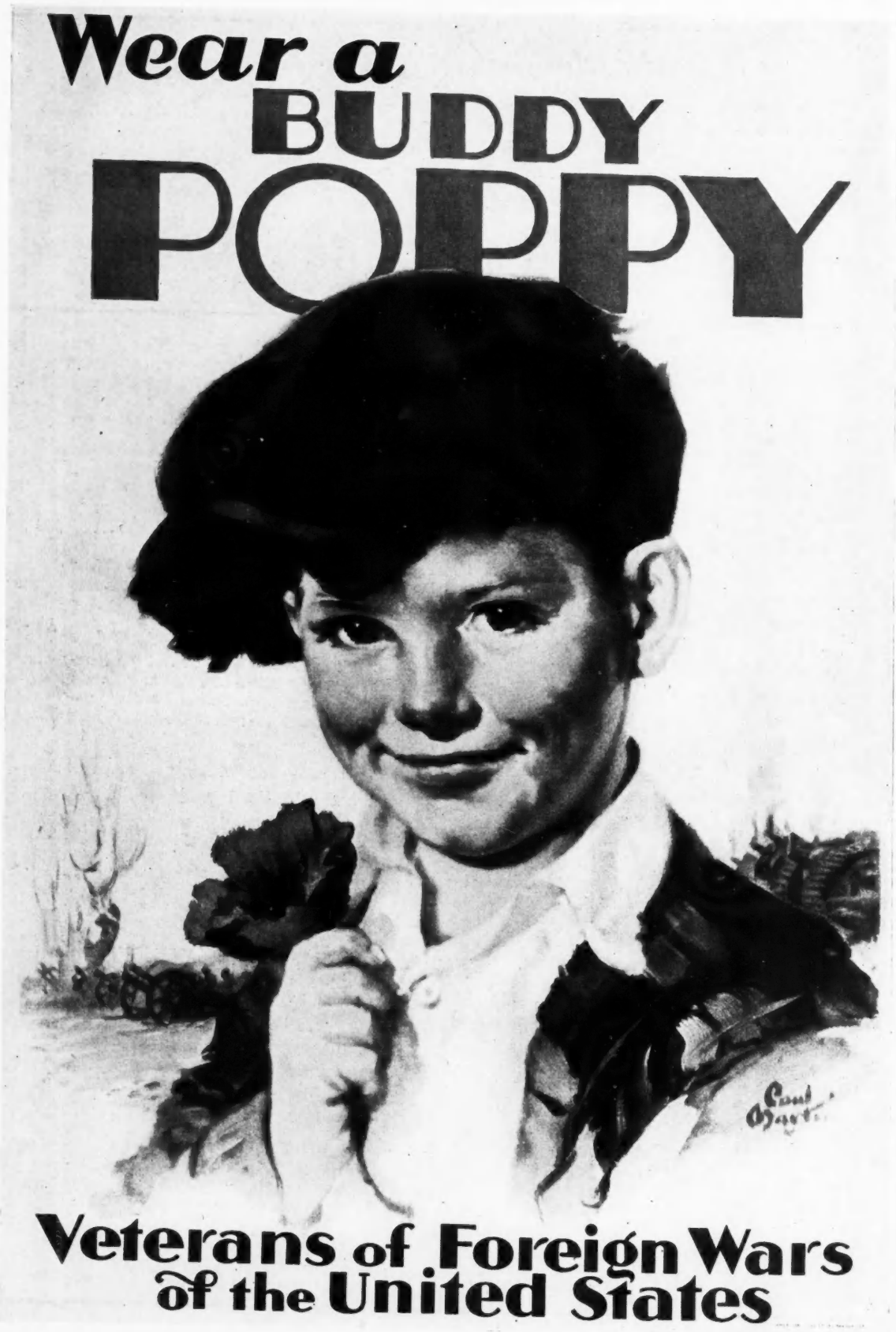
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MAY 29, 1939

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Number 10

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A Fundamental Study of

Vat Printing Pastes

Project 6-33*

III. The Measurement of Color Yield; Use of the Hunter Photox Reflectometer; the Effect of Thickener Solids on Color Yield; a Comparison of Sodium and Potassium Carbonates; the Causes of Heat Rise in an Ager

LELAND F. GLEYSTEEN†

FOREWORD

The accompanying report on Printing Pastes by Dr. Leland F. Gleysteen, until recently Research Associate of the A.A. T.C.C., marks the termination of a project which was started in 1933 and has now been discontinued because the necessary funds for its maintenance are lacking. Whether it will be resumed will depend on the ability of the Association to finance it.

The Advisory Committee feels that the study of Printing Pastes which Drs. Glarum and Gleysteen have conducted has made a real contribution to the printing industry, particularly by establishing on a solid foundation the relation between paste consistency and printing quality. It strongly recommends that all who are engaged in textile printing should read not only the accompanying report but all the previous ones [American Dyestuff Reporter, *23*, 175 (1934); *25*, 150 (1936); *26*, 124 (1937); *26*, 437 (1937); *27*, 303 (1938); *27*, 14 (1938)].

The Committee believes, however, that much work remains to be done. In the first place, our knowledge of printing thickeners is far from complete. It seems quite improbable that starch, converted starch and a few natural gums are the only substances which are suitable to thicken a vat paste. Further, why is it that some thickeners give so much better color value than others? Surely some other factor besides "total solids" is responsible here. Also, it must be admitted that the methods of cooking the various thickeners, as employed in most of our mills, are old-fashioned and are susceptible of improvement. But above all, the ageing process is still much of a mystery, in spite of all the attention which has been given to it through the years. When we consider that the printed cloth as it enters the ager is practically bone-dry; that the dye, imbedded in an inert thickening material, is merely coated on the surface of the fibers in an insoluble state; and that the atmosphere of the ager, above 212° F., is practically devoid of moisture, it seems strange that under these conditions the dye can actually go into solution (under the influence of the alkali and hydrosulfite) and within five minutes or less, migrate away from the thickening and into the fiber. And yet such seems to be the fact. Surely here is an opportunity for a real investigation which will throw light on some of these mysteries and perhaps lead to better and more economical ageing.

Comments and suggestions from all who are interested in these matters will be welcome.

WILLIAM H. CADY
Chairman, Advisory Committee

INTRODUCTION

THIS study of the properties of vat printing colors, and the relation of these properties to printing qualities was started several years ago as a project of the American Association of Textile Chemists & Colorists. In a previous paper, it has been shown that there is a direct relation between the flowing properties of printing colors and their printing qualities[1]. Likewise, it has been shown that the color yield is greatly influenced by the composition and method of preparation of the color[2, 3]. A preliminary study for ageing problems has also been made with very interesting results[3, 4].

It is the purpose of the present communication to present the results of recent experiments, which extend the scope of the earlier studies, and offer refinements in the methods of measuring color yields.

*This project has been carried out by the Research Committee of the A. A. T. C. C., the Sub-Committee on Textile Printing Pastes acting as advisors. It has been made possible through an allocation from the Textile Foundation. Through the courtesy of the Department of Chemistry of Brown University, the facilities of the Jesse Metcalf Chemical Laboratory have been available for this work.

†Research Associate A. A. T. C. C., 1937-1938.

MEASUREMENT OF COLOR YIELD

In previous experiments[2], involving color yield, it was necessary to make all determinations by visual comparisons of the prints. This was recognized as a disadvantage, since the presentation of data of this type shows only that one sample was better or poorer than another, without giving any information regarding the magnitude of the difference. In an effort to discover some means whereby the color yields could be accurately measured, a study has been made of three methods, two chemical and one physical, by which it was hoped to determine the actual amount of dye on the fiber.

1. Reduction with Titanous Chloride[5,6]

Comments: This well-known method, which is successfully used to determine the concentration of azo dyes, failed to yield reproducible results with vat dyes. That adequate precautions were taken to exclude atmospheric oxygen is evidenced by the fact that standardization determinations were reproducible within less than 1 per cent, limits considered satisfactory in view of the use to which the solutions were to be put. Repeated reductions of equal areas of prints of Ciba Blue 2BD and of Calcoloid Pink FF gave variations of as much as 40 per cent. It is

quite likely that the difficulty lies in the fact that several degrees of reduction are possible and that very rigid control of experimental conditions may be required. It appeared that the standardization of such a procedure of analysis would be a long term project in itself.

2. Sodium-Liquid Ammonia Method of Analyzing for Halogen[7]

A halogenated dye is treated with a solution of metallic sodium in liquid ammonia. This solution, a very powerful reducing agent, extracts halogen atoms from organic molecules with the formation of sodium halides. The residue, after evaporation of ammonia, is extracted with warm water to remove soluble materials. The sodium halide is titrated with silver nitrate solution.

Comments: So little sodium halide was present in the case of these extractions that the titration endpoint could not be determined, either with chromate or eosin indicators.

3. Solvent Extraction Method

A piece of fabric, including a clearly defined unit of area printed in one color only, is placed in a Soxhlet extractor which is charged with a suitable solvent. Extraction is continued until the cloth has been completely stripped. The extract is then compared with a standard solution of the same dye, using the Duboscq colorimeter or other suitable device[8]. Obviously, for this method to be applicable, it is necessary to find a solvent which will form stable solutions of permanent hue.

Comments: Extraction with Pyridine: Glarum reports that the solutions change color with time. The writer personally considers this method the most promising of those which have been suggested to date, though possibly some of the less stable dyes cannot be used. Additional work along this line would be desirable. It should be noted that Pyridine may be more completely purified by recrystallization (employing an addition compound with zinc chloride) than by mere distillation.

Extraction with Furfural: Solutions of the dye discolor quickly. The solvent itself becomes yellow to brown on standing.

Extraction with Ethylene Diamine: Vat dyes are not sufficiently soluble in the cold. The dye is stripped from the cloth fairly well, but soon drops out of solution.

None of these methods gave results which were readily reproducible, and therefore they were abandoned in favor of instruments designed to measure color directly by the intensity of light reflected from the colored surface.

The Hunter Photox Reflectometer

Preliminary measurements with several instruments of this type indicated that the Hunter Photox Reflectometer[9] was suited to this study. The use of the Reflectometer in this project was through the courtesy of the Colorimetry Section, National Bureau of Standards.

This instrument consists essentially of two photo cells, one illuminated by light reflected at an angle of 45 degrees from a standard surface, the other by light reflected at the same angle from the test piece. The source of illumination is a lamp placed between the two surfaces, in such a manner that its light is normally incident upon them, and so mounted as to be movable along an axis defined by the two reflecting surfaces, thus allowing the intensity of light falling upon either surface to be increased or decreased. A galvanometer is used to determine the point at which the cells are balanced. The reading obtained is a measure of the reflecting power of the test surfaces. It should be noted that *high* readings represent good reflectance or *poor* color values, and that doubled reflectance does not indicate halved concentration of dyestuff on the fabric.

For purposes of comparison, a table of reflectances from patches on which stripes were printed using pastes made up with three dyestuffs, each in three strengths, is given in Table I. It is not probable that a paste containing 10 per cent dyestuff leaves *exactly* twice as much dye affixed to the fiber as a paste containing 5 per cent dyestuff; however, the table is useful in showing the reflectances obtained in printing with different strength pastes under identical processing conditions.

TABLE I

Effect of Concentration of Dye on Reflectance

Conc. of Dye in Printing Paste	*Reflectance*	
	Blue 2BD	*Jade Green*
5%	.201	.326
10%	.156	.226
15%	.142	.182

It is necessary to observe certain precautions in preparing prints to be subjected to such measurements. This instrument is designed for the measurement of reflectances from smooth, uniform surfaces. This condition is not realized with cloth samples, but reproducible readings can be obtained if a tightly woven fabric, such as 80 x 80 or higher count material, is used, and if care is used in handling the samples so that the threads are not displaced after applying the color. Repeated handling of a sample causes the colored surfaces to be moved aside so that the lighter portions at the back of the fabric will affect the reflectance reading.

EFFECT OF THICKENER SOLIDS ON COLOR YIELD

The effect of the quantity of thickener solids on color yield was investigated by preparing a series of pastes made of corn starch and British gums in varying proportions. Because of the impossibility of exactly reproducing such experimental conditions as the setting of the printing machine, the time and temperature of drying, and the time, temperature and moisture distribution in the ager, all comparisons are restricted to stripes made on single patches. These stripes are printed and processed under the same conditions except for such variations as may exist widthwise in the apparatus involved. It is believed

that when proper precautions are observed, these variations are negligible. Usually four thickener pastes are prepared at one time, differing in concentration, length of time, or temperature of cooking. Each of these is made up with three dyestuffs, and the resultant colors are printed, fixed, and the prints are compared.

A typical experiment, which is illustrative of the results obtained with other starch-gum mixtures, provides the data given in Table II. These particular pastes were made from corn starch and a widely used 80 per cent soluble British gum. Each paste contained 12 per cent sulfoxylate, 6 per cent glycerine and 13.5 per cent soda ash. The printing colors were all made up with 10 per cent dyestuff.

TABLE II

Color Yield as a Function of Thickener Composition

Composition of Thickener		*Total Thickener*	*Reflectances*		
Corn Starch	*Gum*		*Pink FF*	*Jade Green*	*Blue 2BD*
6	6	12%	.309	.212	.148
5	12	17%	.326	.260	.165
4	22	26%	.333	.320	.188
3	28	31%	.339	.297	.188

In general, it may be said that the greater the ratio of gum to starch, the greater the required total amount of thickener, and the poorer the color value. This effect has been reported by Jacoby[10]. It must be observed, of course, that the use of a large amount of starch leads to a stiff print, so that a compromise must be reached between that quality known as "hand" and maximum color yield. Pastes containing a fair quantity of British gum also show better flow characteristics than do pastes very rich in starch.

COMPARISON OF SODIUM AND POTASSIUM CARBONATE PASTES FOR COLOR YIELD

In view of the variations in plant practice in the use of pearl ash and soda ash as the source of alkali in vat printing pastes, it seemed desirable to investigate the color values obtained from pastes which were alike except as to the choice of carbonate. A greater weight of potassium carbonate must be used to provide a molar concentration equal to that of sodium carbonate in making the comparison. Seven different dyestuffs, chosen because they were reported to be widely used, were used in these tests:

Pink FF	Golden Orange RRT
Blue 2BD	Scarlet G
Jade Green	Blue RCL
Violet RR	

As in all other experiments in which colors were compared, all similar colors were printed on a single piece of cloth (80 x 80 mercerized cotton), which was aged, chromed, soaped and rinsed in one piece, so insuring that each color used on that patch received the same treatment as the others with which it was compared.

Sixteen comparisons of the color yield of pearl ash and soda ash pastes were made using the dyes listed above. The resulting prints were compared visually. In all cases, the differences in shade were so slight as to border on the limit of visual discernment. Eight times the pearl ash paste was rated as the better; the soda ash paste was rated better seven times; and in one case there was no difference.

The conclusion to which these experiments lead is that, insofar as color value is concerned, there is no definite claim of superiority to be substantiated for either pearl ash or soda ash.

Two contentions are sometimes put forward to justify the use of the more expensive potassium carbonate: (1) greater color value, and (2) greater solubility. The first of these contentions is doubtful in view of the experiments just described. There is no question as to where the advantage of solubility lies, but it is of interest to examine the saturation isotherm of the system Na_2CO_3 — K_2CO_3 — H_2O at 20° C. This isotherm, Figure 1*, was calculated from the data of Hill and Miller[11].

We see from the diagram that a saturated solution of soda ash in water contains 28 mol. per cent sodium carbonate (calculated on the basis of the anhydrous salt), whereas a saturated solution of pearl ash contains 59 mol. per cent of potassium carbonate, also taken on the anhydrous basis. The maximum total mol. fraction of dis-

*The method of graphical representation here employed is usually described in elementary text books on physical chemistry. The apex marked A represents pure potassium carbonate, that marked B pure sodium carbonate, and C pure water. Points on the line A-C correspond to mixtures of potassium carbonate and water in the proportions: mols. K_2CO_3 : mols. H_2O :: distance A to point in question: distance C to point. The other two sides of the triangle have similar meaning. All points within the triangle and above the curve a-d represent the composition of unsaturated solutions; all points on the curve represent the composition of saturated solutions.

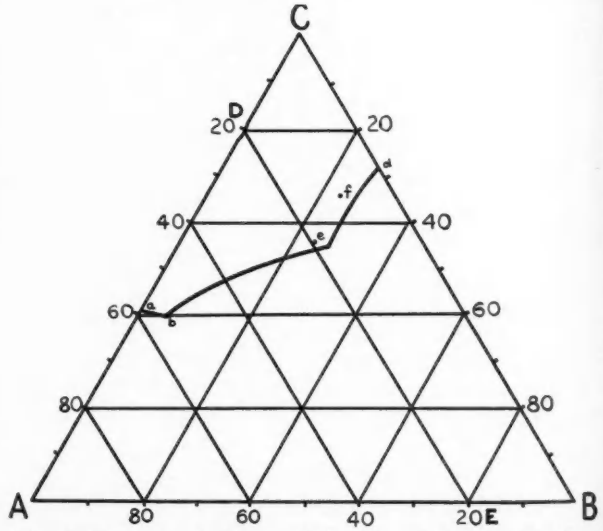


Fig. 1—Saturation Isotherm of the System Na_2CO_3—K_2CO_3—H_2O at 20° C.

solved alkali carbonate is given by the point *b*, 55.5 mol. per cent K_2CO_3 and 4.3 mol. per cent Na_2CO_3.

The point to be emphasized is that in case soda ash is not sufficiently soluble and tends to crystallize out, equivalent or greater alkalinity may be obtained by diminishing the content of soda ash somewhat and replacing it with an equivalent or greater quantity of pearl ash, so taking advantage of the enhanced solubility of mixtures of the two carbonates without losing entirely the advantage of lower cost of soda ash.

For example, the point *e* represents an unsaturated solution containing 24 mol. per cent sodium carbonate and 20 mol. per cent potassium carbonate, and the point *f* represents a solution containing 24 mol. per cent sodium carbonate and 10 mol. per cent potassium carbonate. These examples illustrate how the alkalinity, which is proportional to the total mol. fraction of alkali carbonate, may be greatly increased beyond the alkalinity of a saturated solution of sodium carbonate.

RAPIDOGEN AND INDIGOSOL COLORS

A preliminary study has been made of the relation between the printing quality and the flow properties of rapidogen and indigosol colors. Due to the great prevalence of blotch and heavy figured patterns, it was not feasible to restrict the study to fine line patterns. The wide variations in flow properties of these colors, as measured by the Stormer Viscometer, is made evident by Figure 2, which shows the flow curves for those pastes which were graded as fair or poor. The starred curves represent pastes which had to be returned to the color shop for improvement. It is at once evident that a great majority of these pastes have flow curves far from the zone which includes the most satisfactory vat pastes; many of them also diverge widely from what appears to be a "happy medium" for rapidogen pastes. The variation in patterns cannot be held to be the cause for this wide spread because some of the thickest, as well as some of the thinnest, pastes were used for blotch patterns, and the same observation holds for the fine line patterns.

It is apparent that some standardization of rapidogen pastes would be desirable, and that further data to assist in a correlation of flow properties with printing quality are needed. It should be possible for some of the larger print works to carry out such a program in their own laboratories; the only equipment required is a suitable viscometer and a stop-watch. The accumulated data from the routine testing of pastes over a period of several months or a year, catalogued as to type of pattern, etc., could probably be analyzed to yield valuable generalizations as to the most suitable flow characteristics for rapidogen and indigosol colors.

THE USE OF A VISCOMETER FOR ROUTINE CONTROL

In earlier papers of this series, Glarum[1] has shown how, by some very simple and quick tests with a suitable

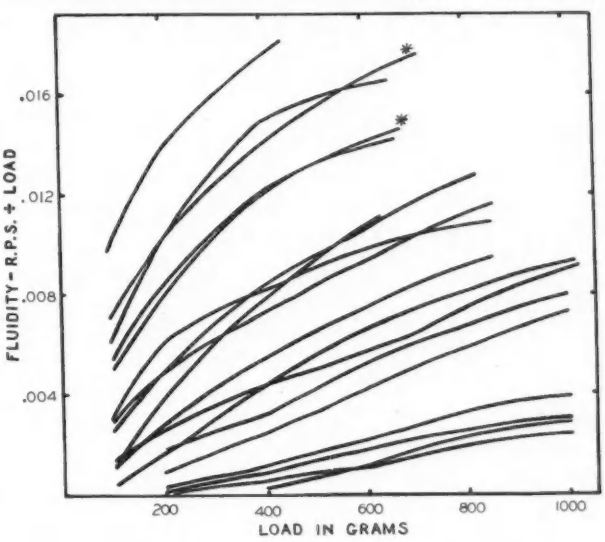


Fig. 2—Flow Curves of Rapidogen and Indigosol Colors.

viscometer, it is possible to predict, with a reasonably good degree of precision, whether or not a given printing color is likely to give a good mark. This situation immediately poses the question: Would it not be advantageous to run routine viscometric controls on all pastes coming from the color shop? Such a system of routine control would not be very expensive. A viscometer is not an expensive instrument, and it may be operated by a person with no technical training. At least two important items can be achieved: first, starches and gums could be compared with regard to what might be designated "thickening power," and second, pastes of improper flow characteristics would be intercepted at the color shop.

There is evidence to the effect that the starch and gum houses are using viscometer measurements to study and possibly to standardize their products. Similar study by the users of those products would be expected to pay its own way. Although print works' cost departments vary over a wide range in their estimates of the hourly cost of running a printing machine and in their estimates of time lost in shut-downs due to faulty printing colors, it is obvious that if even infrequent shut-downs could be eliminated, a desirable saving in operating costs would result.

During a survey by the writer of the vat pastes in use in New England mills, shut-downs of this nature were encountered. The colors involved, when tested in the viscometer, gave flow curves indicating that the pastes were too thin; after the trouble had been corrected, the flow curves fell in the "Good" zone designated by Glarum[1]. In other words, it was possible for the operator of the viscometer, before the colors were put in the machine, to predict that they probably would not work well, and to indicate the nature of treatment suitable for their correction. The time lost might well have been avoided had advantage been taken of this method of control.

Here is a problem peculiarly suitable to study in and by the mills. A thorough study of a mill's pastes, made by the laboratory or color shop, with a strict accounting of its costs, savings and any other benefits would be a valuable and relatively inexpensive contribution to the progress of the transition of printing paste preparation from a trial and error to a systematized basis.

THE CAUSES OF HEAT RISE IN AN AGER

It has already been shown[4, 12] that the heat evolved when cotton is wet with steam is somewhat greater than the heat of condensing steam to water, and that this heat of adsorption is more than enough to account for all the heat produced when unprinted cotton is run through an ager. It is not surprising that printed cotton exhibits a greater development of heat since it carries with it a substantial amount of starch or gum which adsorbs[13] about the same amount of water as cotton does, with about the same evolution of heat. It is also interesting that viscose rayon, which adsorbs more water than cotton does, produces more heat in the ager. These conclusions are all deduced by the methods of thermodynamics from the relation of moisture regain to humidity, and therefore represent equilibrium conditions only and furnish no information concerning the rate at which heat is developed.

It is well known that extremely dry cotton absorbs moisture with great avidity, even perhaps as rapidly as phosphorus pentoxide does if the cotton is very dry. It is also well known that practically all the heating occurs in the part of the ager where the cloth enters. In order to form a more concrete notion of the speed of this reaction and the consequent temperature rise, it seemed desirable to perform an experiment in the laboratory.

A flask was equipped with an inlet and outlet for air and two thermocouple junctions. One thermocouple was wrapped with cloth and the other was bare. These two junctions served to indicate the temperature difference of the cloth and its surroundings. A current of hot dry air was passed through the apparatus until the cloth was completely dry. The apparatus and contents were cooled in a stream of dry air to room temperature, and a current of air saturated with moisture at room temperature was admitted. From the change of potential between the two junctions, the temperature differences were calculated and were plotted as a function of elapsed time. Successive determinations checked as well as could be expected considering the nature of the apparatus.

Figure 3 shows the time-temperature curves for cotton and viscose rayon. For rayon (I) the maximum temperature rise was about 11.7° C.; for cotton (II) about 6.2° C. The curves show that the initial rise of temperature is very rapid and reaches a maximum in two minutes or less after which it falls off more slowly due to radiation. Any attempt to analyze these curves mathematically leads to complexities. Such an analysis must include the consideration that as soon as the goods become hotter than the surroundings they begin to dissipate heat at a rate that is dependent on the temperature differential, the velocity of the air currents, the thickness of the goods and many other factors. Most of these same factors also affect the rate of moisture adsorption. It is also true that as soon as the film of air immediately surrounding the goods becomes warmer, due to radiation, its relative humidity is lower, and in consequence its tendency to impart moisture to the fabric. Qualitatively, the experimental results are in harmony with the thermodynamic conclusions and the known facts regarding the velocity of the adsorption process. It is important to note that rayon, which adsorbs about twice as much moisture as cotton does under the same conditions[14], exhibits about twice the maximum temperature rise.

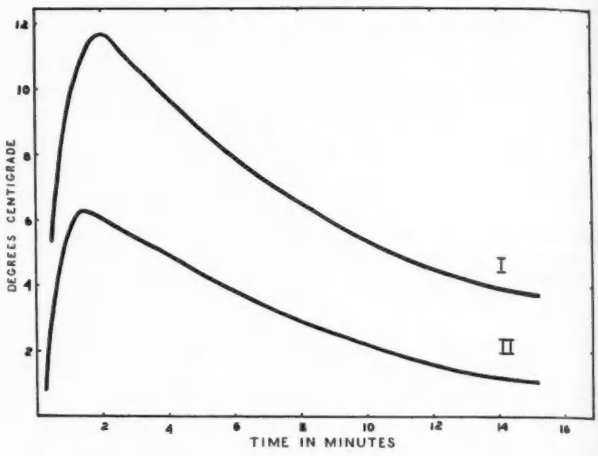


Fig. 3—Temperature Increase on Wetting Dry Rayon and Cotton.

ACKNOWLEDGMENT

The writer is happy to acknowledge the great assistance proffered by the printing industry, the American Association of Textile Chemists and Colorists, the Printing Paste Committee, and particularly Messrs. Cady, Strachan and Glarum, who have devoted a great deal of their time to the guidance of this research and to the preparation of this report.

REFERENCES

[1]Glarum, Am. Dyestuff Reptr. *25*, 150 (1936).
[2]Glarum, ibid., *26*, 437 (1937).
[3]Gleysteen, ibid., *27*, 14 (1938).
[4]Strachan, ibid., *27*, 240 (1938).
[5]Knecht and Hibbert, New Methods in Volumetric Analysis, Longmans, Green, N. Y.
[6]Flynn, Am. Dyestuff Reptr. *12*, 316 (1923).
[7]Scott's Standard Methods of Chemical Analysis, 5th Edition, Vol. I, p. 266, Van Nostrand, N. Y.
[8]Kolthoff and Sandell, Textbook of Quantitative Analysis, p. 615, Macmillan, N. Y., 1936.
[9]Hunter, J. Optical Soc. Amer., *26*, 225 (1936).
[10]Jacoby, Am. Dyestuff Reptr. *27*, 349 (1938).
[11]Hill and Miller, J. Am. Chem. Soc., *47*, 669 (1927).
[12]Stamm and Loughborough, J. Phys. Chem. *39*, 121 (1934).
[13]Swan, I. Text. Inst. *17*, T527 (1926).
[14]Urquhart and Eckersall, Shirley Inst. Memoirs, *11*, 75 (1932).

Water Repellency and Temperature*

H. W. STIEGLER and J. M. HOOD

THE temperature of the water used in evaluating water repellent finishes may be responsible for the rejection or acceptance of a given finish, regardless of the true merit of the finish or the agent used in producing it. Unfortunately the importance of this temperature factor in making comparative tests has been practically neglected in carrying out both the crude methods widely used in many mills for rapid estimation of repellency and in the more accurate, refined methods necessary for the proper evaluation and rating of finishes.

A given finish or agent actually may vary 100 per cent in its repellency rating, depending on the temperature range of the tap water ordinarily used for conducting water repellency tests in mills or laboratories. This temperature range may vary from 50° F. or lower in winter to 80° F. or above in summer. Therefore, unless tests are carried out under the same temperature conditions they are without value for comparing water repellent finishes or agents. The degree of repellency obtained holds only for the given temperature at which the test is carried out.

Ordinarily tests are made with "cold" water—which means nothing more than that the water is drawn from a tap marked "cold." The temperature of this water varies within a wide range and is governed not only by the season of the year but by such factors as the main source of supply (reservoir, well, river, etc.), the length of the pipe line leading to the tap and the proximity of this line to steam lines, passage through hot or cold areas, speed of flow or dwell within the line, etc.

TESTS

There are many types of tests for evaluating water repellency. These tests vary in effectiveness and reliability with the nature, construction and use of the fabric being tested. In general the tests are made by observation or measurement of absorption of water by immersion, spraying, etc.; surface repellency; resistance to hydrostatic pressure; moisture and air penetration and many modifications of these methods. The type of test selected depends on the use to which a textile fabric is to be put.

Mechanical rubbing of the fabric and motion of either water or fabric are frequently incorporated in the tests. Details of these tests have been frequently published.

Immersion tests do not give information regarding repellency to driving rain. Hydrostatic tests are carried out by subjecting the fabric to hydrostatic pressure increasing at a constant rate and noting the pressure required to force water through the fabric, degree of absorption, etc. Related to this test are the more simple trough or bag tests in which water is placed in a trough or bag of the fabric to be tested and the time of penetration noted. The hydrostatic test involving increasing pressure is more satisfactory for tightly woven or heavy fabrics than for light ones.

One of the most frequently used tests for rapid evaluation in the mill involves holding a piece of cloth taut and at an angle under a thin stream of water from a tap and noting the behavior as the water strikes the surface and rolls off or clings. A more accurate modification of this is to place a given amount of water in a funnel and allow it to run over a taut piece of cloth placed at a fixed distance and angle below the funnel. Drop tests which involve dropping water from a given height on cloth placed at a definite angle are related to these tests and to the spray tests.

The spray test has been described (A. A. Cook and J. Zaparanick, American Dyestuff Reporter, June 14, 1937) and consists in subjecting the weighed cloth to a spray of water at a fixed head of pressure for a definite time and reweighing to determine absorption. With certain modifications this spray test provides a very accurate quantitative and reproducible method of evaluation.

All tests should be carried out with accurate control of water temperature.

ERROR DUE TO TEMPERATURE

Since the temperature of the water markedly influences the degree of repellency, it is obvious that the frequently used rapid test wherein the cloth is held under a thin stream of water from the tap is especially open to serious error. If a series of finishes on a given fabric or a series of repellents are being judged, the first piece held under the tap is apt to be tested under the adverse condition of a stream of warm water coming from a warm pipe line. As more samples are tested and more time has elapsed for the water to flow increasingly colder, the repellency values will definitely improve, so that the last samples are tested under an undue advantage. Thus the whole series is out of line with respect to true comparative repellency. Sometimes a spray test might be carried out in summer and the results referred to figures obtained in colder months when water was running very cold. Temperature control

*Contribution from American Cyanamid Co., Textile Chemicals Laboratory, Stamford, Conn.

is obviously necessary in running tests of any kind on repellency.

QUANTITATIVE EFFECT OF TEMPERATURE

The data given illustrate quantitatively the influence of water temperature on the degree of repellency obtained with some of the most effective repellents now on the market.

The Spray Test was chosen as the most useful, accurate and generally available test for demonstration. A number of modifications were made to increase accuracy. These include a larger reservoir, automatic temperature control, a 10-second drain period after spraying and blotting off excess surface drops instead of scraping or shaking them off. The diagram in Plate No. 1 illustrates the general features of the test and equipment.

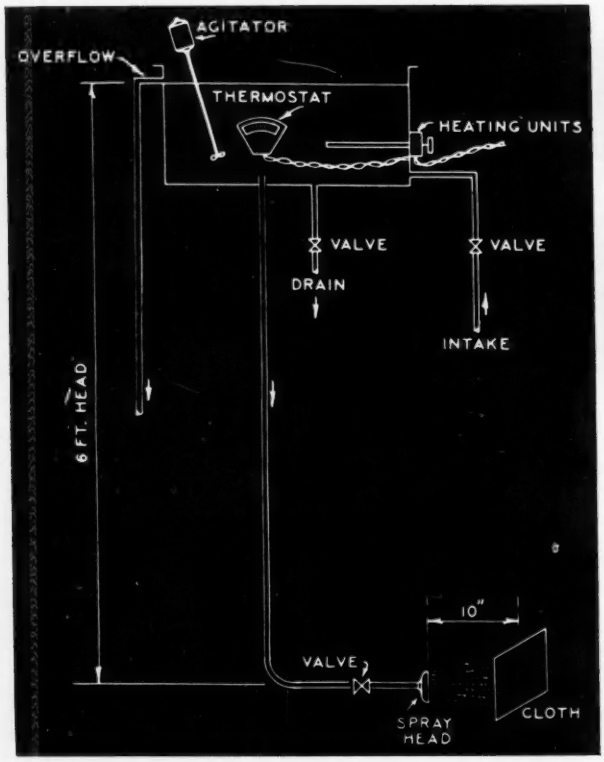


Plate No. 1—Spray Test for Determining Water Repellency.

Plate No. 2 pictures the actual set-up as made from an ordinary copper wash boiler, heating units and thermostat. The 3-inch spray head is the kind used for spraying flowers and is readily obtainable.

The apparatus may be used for constantly maintained water level or for intermittent tests where the reservoir is filled, brought to temperature and the requisite 1 minute's supply of water drawn through the spray head. The reservoir is so large that 1 minute's supply (about 1.5 gal.) lowers the head only about 1.5 inches. Whichever method

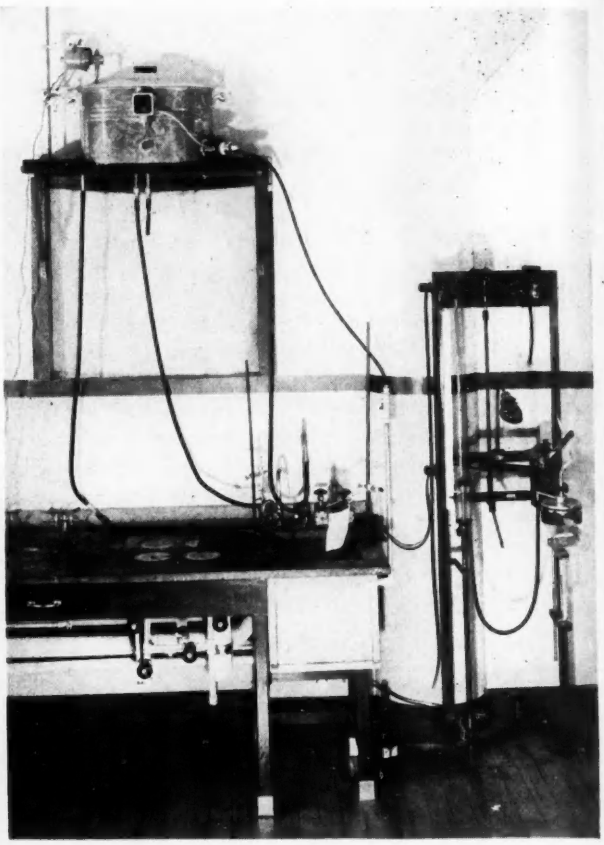


Plate No. 2—Spray Test and Hydrostatic Test for Determining Water Repellency.

is adopted, the conditions are identical from test to test. The latter method provides the surest temperature control. The reservoir is quickly refilled and automatically brought to temperature for the next test while the test cloth is being weighed. If a thermostat is not available, the temperature of the water in the reservoir may, of course, be controlled manually by means of steam coils, hot water, etc. If the water supply in the mains in summer runs above the standard temperature chosen for tests, it may be cooled by a small refrigerating unit (available for instantaneous cooling in drinking fountains) or manually by means of ice.

STANDARD TEMPERATURE

Water may run as low as 50° F. in winter and 80° F. or more in summer. A standard of 70° F. might be desirable for comparing water repellents for summer dress-goods, suitings, etc. For winter sports goods a lower standard such as 50° F. might be adopted.

THE TEST

The test is run by weighing a 6-inch square of treated cloth, which has been conditioned in air under ordinary room-temperature and humidity if no constant humidity room is available, suspending it by clamps or hooks at a

distance of 10 inches from the spray head, starting the spray and running it for 1 minute by stop-watch. The cloth is allowed to drain 10 seconds and it is then quickly placed between two flat sheets of filter paper and a steel or heavy glass rod is quickly rolled once over the top. The cloth is immediately placed in a weighing bottle and weighed for increase due to absorbed moisture. The filter paper treatment is necessary for accuracy, as the size of the mechanically held drops on the surface varies, thus causing inaccurate results unless the drops are removed. Scraping or shaking the cloth to remove surface drops is open to variable results. Shaking is apt to remove water which has been forced into the interstices and which should normally be weighed. Scraping is apt to leave varying amounts of excess water on the surface in the form of a film.

Two checks are run and usually check each other within 1 per cent or less. The figures given in the tables are the average of two tests.

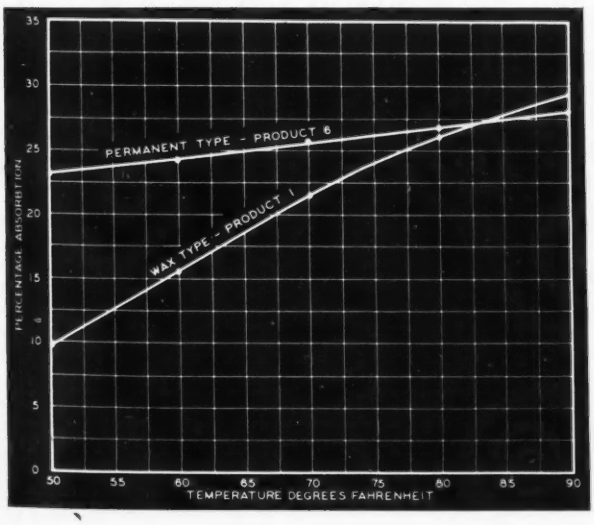
Plates No. 3 and No. 4 illustrate the effect of water temperature when some of the most effective wax type and permanent repellents were subjected to the spray test.

PLATE NO. 3
Temperature and Repellency
Spray Test on Six Repellents*

Spray Water Temp. °F.	*Per Cent Absorption (1 Minute Spray)*					
	No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*	*No. 6*
50	9.8	16.5	11.2	12.0	25.3	23.2
60	15.5	24.0	14.6	18.5	27.2	24.3
70	21.5	24.5	19.3	21.6	27.8	25.8
80	26.0	25.8	25.4	28.5	28.5	26.7
90	29.2	28.2	26.7	32.5	29.2	28.1

*Samples Nos. 1-4 are wax types and Nos. 5-6 are permanent types.

Plate No. 4—Temperature and Repellency—Interpolation from Curves for Intermediate Temperatures.



Bleached unsized 80 x 80 cotton cloth was impregnated with 5 per cent emulsions of the repellents for the test.

It will be seen that between 50° and 80° F. a variation of 100 per cent in absorption is possible. The wax type repellents appear to be more effective repellents in the lower temperature ranges, while the permanent types seem to maintain a higher but fairly constant absorption, regardless of the temperature. If a five-minute spray is used, the same general relationship is maintained between the products as for the one-minute spray except that at 70° F., for instance the absorption runs slightly higher (between 30 per cent and 33 per cent for wax types, and 30 per cent for permanent).

EFFECT OF CLOTH CONSTRUCTION

Cloth construction, yarn and twist have a definite influence on the degree of water repellency. Naturally, comparative tests of water repellents should be carried out on the same cloth.

The following cotton fabrics (Plate No. 5) were made repellent with Product No. 1 and submitted to a one-minute spray test at various temperatures.

PLATE NO. 5
Fabric Construction and Per Cent Water Absorption

	Yds. per Lb.	*Temp. of Spray Water, °F.* 50	60	70	80	90
88 x 40 37" Cotton Drill	2.85	6.1	8.0	10.7	15.8	25.0
72 x 120 43" Carded 3 leaf twill	3.35	6.0	8.4	8.1	18.4	24.7
68 x 72 39" Regular Cotton Percale	4.75	8.0	8.3	8.5	12.7	25.3
80 x 80 36" Cambric	4.00	9.8	15.5	21.5	26.0	29.2

Comparison or evaluation of water repellents or water repellent finishes should be carried out under a definite procedure including accurate temperature control and consideration of fabric construction.

REPORT OF THE COMMITTEE ON COORDINATION OF STANDARDS

YOUR Committee has given consideration to the question of informative labelling of textile materials, from the standpoint of the possible interest of the American Association of Textile Chemists and Colorists. We are in unanimous agreement on the following points which constitute our recommendations to the Council:

1. The Association should not sponsor any privately organized system of labelling.

2. The Association should not itself set up any laboratory for commercial or umpire testing.

3. The Association should give definite recognition to an increasing demand for some form of informative labelling. Such recognition we think should be evidenced by:

a. Immediately bringing up to date all tests so far devised by the Association.

b. Immediate improvement or completion of tests still in the provisional group.

c. Amplification or interpretation of the tests so as to make them understood and suitable for use by other groups including merchandisers and consumers.

d. Printing in pamphlet form for rather widespread distribution the tests with instructions as to their use and interpretation.

e. Assigning a man full time to carry out this program.

SETTING UP OF LABORATORY

In the opinion of the Committee, our Association will be in a stronger position if it qualifies itself as the outstanding authority as to test methods and the meaning of the tests themselves. We believe that it will expedite general acceptance of the tests and of the position of the Association as an authority, if the Association does not compete with laboratories already in existence. The setting up of a laboratory would naturally entail a considerable initial expense and also a continuing expense. Even assuming that the Association had enough money to create the laboratory in the first place, it would still have to set up some scheme of charging for the tests it would make, in order to pay its way. This would inevitably create some opposition, and therefore might operate against a wider use of the Association's methods, which of course would be contrary to the objects sought. In addition, our Association does not cover all fields of textile testing. On the whole we believe that the objects sought can be best attained through cooperation with all other groups rather than by competition with any.

WHAT THE ASSOCIATION SHOULD DO

No matter from what quarter it comes, there is an increasing interest, if not demand, for some progress in informative labelling. This demand is being increased by activity in the organization of consumer groups, which may themselves ask for compulsory action by some body such as the Federal Trade Commission. Regardless of where the demand originates, the tests themselves, plus the method for their use and the interpretation of results, should be devised by someone well qualified. Our Association seems preeminently fitted to do this job. But if we are to take and keep the leadership in this phase of the whole problem, we must act promptly and continuously.

For this reason we make recommendation "e." Almost all the vast amount of work already done has been volunteer effort. Every man who contributed of his time and services had his own job to take care of first. It is a great tribute to the Chairman of the Research Committee, and all the men who helped, that so much has been accomplished in this manner. In our opinion the problem now becomes quite different. If recommendations a, b, c, and d are to be carried out promptly, it is obvious that no member can devote all of his time to the job. It is on the other hand unquestionably true that handling in the manner recommended will require all of a man's time.

Recommendations "a" and "b" probably require no discussion. Recommendation "c" we think is important. Many firms, groups or organizations now use our tests to the extent that they lend themselves to their particular requirements; but many people find it necessary to add tests or to change in some way. The reasons should be determined and the remedy found. Then again a test designated by letter or number may be sufficient for a textile manufacturer, but unsuitable for a merchandiser or consumer. Some reconciliation is needed, as well as interpretation, so that the tests can be used by other groups and their meaning known.

Recommendation "d" covers the publicizing and policing of the tests. The tests printed and put into the hands of associations, laboratories, etc., should receive some supervision to see that they are properly performed and correctly interpreted. The supervision itself would also develop or discover the needs for revision or improvement.

HENRY F. HERRMANN
WILLIAM D. APPEL
ELVIN H. KILLHEFFER, *Chairman.*

At a meeting of the Council in New York on February 11th, 1939, this report was presented, and a new committee, consisting of E. H. Killheffer, Chairman, W. D. Appel, W. H. Cady, H. F. Herrmann, and L. A. Olney, was appointed to consider recommendation "e" of the report. This committee was authorized by the Council, at its meeting in Philadelphia on April 21, to appoint a man, to serve under the direction of the Research Committee in carrying out the recommendations of the above report.

MEMBERSHIP ON MAY 1, 1939

	Senior	*Junior*	*Associate*	*Student*	1939 *Total*	1938 *Total*	1937 *Total*
Northern New England	248	43	36		327	311	303
Rhode Island	214	39	28	14	295	284	256
New York	384	49	50		483	451	409
Philadelphia	311	34	36		381	369	326
Piedmont	213	31	33		277	247	238
South Central	48	9	5	1	63	56	41
Southeastern	83	5	37	8	133	109	55
Mid West	130	6	19	2	157	158	147
Lowell Textile Institute.				25	25	19	11
North Carolina State College				8	8	10	5
Philadelphia Textile School				18	18	28	25
No Section	52	7	10	2	71	65	55
	1683	223	254	78	2238	2107	1871
Corporate					32	30	30
					2270	2137	1901

Report of the

Rayon Crepe Research

VII—The Effects of Some Variations in Dyeing and Finishing upon the Pebble of Rayon Crepe Fabrics

The Rayon Crepe Research was conducted jointly by the Throwsters Research Institute, Inc. and the A.A.T.C.C. The financing of the program was made possible through a grant from the Textile Foundation to the A.A.T.C.C. and this grant was matched by contributions raised by the Throwsters Research Institute, Inc. from the industry and generous donations from their own treasury. W. F. Macia was the Research Fellow.

Parts I, II and III appeared in the November 1, 1937, Quarterly Research Number. Part IV appeared in the January 10, 1938 Number, Part VI in the April 3, 1939 Number, Part V in the May 1, 1939 Number and Part VII is presented herewith.

The work in each part of this program is so closely related that the reader is cautioned against drawing conclusions wholly on the basis of the results of the individual parts. The Rayon Crepe Research Committee will correlate all of the data and publish their conclusions in the final issue.

INTRODUCTION

IT was the purpose of this part of the Rayon Crepe Research to determine the amount and type of influence that some variations in the dyeing and finishing operations exerted upon the pebble of rayon crepe fabrics.

SUMMARY

There were thirty-six (36) pieces of rayon crepe fabrics processed in a commercial dyeing and finishing plant. Four pieces were used as standards or control pieces while thirty-two were processed under various conditions created in the individual operations. Some of the variations imposed in the individual operations were greater than any expected to be found in a controlled commercial plant. The specially treated pieces were judged by comparing them with the standard or control pieces.

The results of this investigation were as follows:

(1) Differences in pebble of rayon crepe fabric can be produced in dyeing and finishing plants.

(2) Variations in the boil-off had considerable influence upon the pebble of finished fabric.

(3) High warpwise tension in boil-off had more influence than any other variation in the plant.

(4) Variations in the scouring after boil-off and in the dyeing operation had no influence upon the pebble.

(5) Variations in drying had no influence upon the pebble.

(6) Variations in tentering influenced the pebble.

(7) Processing the fabric on the button breaker influenced the character of the pebble.

(8) Calendering flattened the pebble and changed the character.

(9) By boiling-off with extremely low warpwise tension and allowing the fabric to accumulate in the bottom of the boil-off tank variations in pebble were produced within the length of the pieces processed in this manner. This treatment resulted in irregularities or fold marks. In no other instance was there any variation within the length of individual pieces.

SCOPE

This investigation was made to determine the extent of influence that could be exerted upon the pebble of rayon crepe fabrics in the dyeing and finishing operations and to determine the specific operations which had the greatest influence upon the pebble.

To accomplish this purpose thirty-six pieces of rayon crepe fabric were processed under various conditions in a commercial dyeing and finishing plant. Four pieces were processed using a standard procedure as a basis of comparison. Intentional variations were imposed in each operation and thirty-two pieces were processed under the conditions imposed. As in some of the other work in this research some of the variations imposed were far more extreme than those experienced in controlled commercial production. The methods used in processing the control pieces however were similar to general commercial practice.

The greige pieces were from the production of a large manufacturer of rayon crepe fabrics. They were constructed with 96 ends of 150 denier acetate rayon and 48 picks of 200 denier viscose crepe rayon woven with 4 picks of "S" and 4 picks of "Z" twist. Care was taken to select pieces that were made from one lot of warp yarn and one lot of filling yarn. Two pieces were processed as one, as a means of detecting any variations that might inherently exist between pieces. Since the double pieces were treated as individuals they were identified as single pieces.

Identification

The pieces were processed and identified as follows:

Piece No. 1—Control piece
Piece No. 2—Boiled-off at low temperature
Piece No. 3—Boiled-off with high warpwise tension
Piece No. 4—Boiled-off with low warpwise tension
Piece No. 5—Given an extreme amount of scouring after boil-off
Piece No. 6—Not scoured
Piece No. 7—Dyed in an extremely soapy bath at the boil
Piece No. 8—Dyed in a neutral bath
Piece No. 9—Dryed at high temperature
Piece No. 10—Dryed at low temperature
Piece No. 11—Tentered with high warpwise tension
Piece No. 12—Tentered with medium warpwise tension
Piece No. 13—Tentered with low warpwise tension
Piece No. 14—Tentered to 37" instead of 39"
Piece No. 15—Passed through the button breaker
Piece No. 16—Calendered with heavy pressure
Piece No. 17—Calendered with light pressure
Piece No. 18—Control piece.

Details of Processing

With the exception of pieces No. 1 and No. 18, which were the control pieces, all of the pieces were dyed and finished in a different manner. The standard or control pieces, No. 1 and No. 18, were processed in a conventional commercial manner as later described.

The other pieces were processed in the same way in most of the operations but were handled differently in one of the individual operations. For example, piece No. 2 was boiled-off differently from the other pieces but was processed in the same way as the control pieces in all of the other operations. This made it possible to determine the effects of variations in the individual operations.

The methods used in processing the standard or control pieces will be described in detail and where the changes in individual operations were made the details will be given but where the methods were the same as the standard procedure the details will not be repeated.

The methods used in processing the standard or control pieces were as follows:

Marking and Beaming

All of the pieces were marked with indelible pigment for identification, sewn together with a flat stitch and beamed.

Boil-off

The pieces were boiled-off in a continuous boil-off machine which consisted of three separate units. The first unit consisted of a rectangular tank having a capacity of 2,000 gallons of boil-off liquor; was equipped with an entering or submerging wheel to convey the fabric into the bath in flat form; had submerging rolls at both ends and a small conveying wheel to remove the fabric from the tank.

The boil-off bath in this unit contained the following ingredients:

Soap flakes—90 lbs.
$Na_6P_6O_{18}$ (Calgon)—2 pts. (30 per cent solution)
$C_{17}H_{33}CO.NH.C_2H_4SO_3Na$ (Igepon T. Gel.)—15 qts.
Caustic—2 lbs.
Pine Oil*—10 qts.
Total volume—2,000 gallons

This bath was maintained at 180° F.to 195° F.

The second boil-off unit consisted of secondary tank having a capacity of 800 gallons. The fabric was fed from the first unit into the second unit in flat form and then was allowed to accumulate until it was drawn out, converted through eyes into rope form and fed into the third unit.

The bath in this second unit contained the following ingredients:

$Na_6P_6O_{18}$ (Calgon)—1 pt.
Soda ash—1 lb.
Total volume—800 gallons.

The temperature of this unit was maintained at 180° F.

The third unit consisted of a large tank having several small compartments, through which the fabric was passed in rope form. The bath in this unit contained the following:

Soap flakes—50 lbs.
$Na_6P_6O_{18}$ (Calgon)—2 pts.
$C_{17}H_{33}CO.NH.C_2H_4SO_3Na$ (Igepon T. Gel.)—15 qts.
Soda ash—4 lbs.
Pine oil*—7 qts.
Total volume—4,000 gallons

This bath was maintained at 170° F.

The total time that the pieces were in the boil-off units was approximately thirty minutes.

Note—After processing each 6 piece group 2 quarts of a replenishing solution consisting of the following ingredients were added to the first and third units:

$Na_6P_6O_{18}$ (Calgon)—10 pts.
$C_{17}H_{33}CO.NH.C_2H_4SO_3Na$ (Igepon)—4 gallons
Soap flakes—80 lbs.
Total volume—220 gallons.

Scouring

The pieces were scoured in the dye beck for one hour to remove any extraneous matter remaining after boil-off.

The scouring solution used consisted of the following:

$Na_6P_6O_{18}$ (Calgon)—0.3 per cent (on wt. of goods)
Soda ash—0.5 per cent
$C_{17}H_{33}CO.NH.C_2H_4SO_3Na$ (Igepon)—0.3 per cent

The temperature was maintained at 180° F. during this operation.

Note—No study was made of the comparative merits of the ingredients and dyes used. The particular ingredients and dyes were used because they were available in the plant in which the work was done.

*The pine oil used was prepared with 1 part of pine oil, 1 part of a 50 per cent sulfonated castor oil and ½ lb. of Igepon per gallon.

Dyeing

After scouring the pieces were thoroughly rinsed then dyed in rope form in an all stainless steel beck. They were circulated in a cold bath for a few minutes then the following dyes and ingredients were added to the bath:

S.R.A. Blue III—0.9 per cent (on wt. of goods)
Calconese Blue B—0.3 per cent
Niagara Blue G—0.1 per cent
Calcomine Violet N—0.03 per cent
$Na_6P_6O_{18}$ (Calgon)—0.3 per cent
Soda Ash—1.5 per cent
$C_{17}H_{33}CO.NH.C_2H_4SO_3Na$ (Igepon)—0.3 per cent
Pine oil—1.3 per cent
Common salt—4.0 per cent

The temperature was gradually raised to 180° F. and the pieces circulated for five hours and twenty-five minutes to insure complete penetration of the dye. The bath was then flooded off and the pieces rinsed first in warm then cold water. They were finally rinsed in a solution of acetic acid (4.3 per cent of 28 per cent acid on wt. of goods), removed from the beck and hydro-extracted in a centrifugal extractor.

First Drying

The pieces were dried in a loop or slack type dryer through which they were continuously carried in festoon form. The first chamber of the dryer was maintained at 270° F. and the second chamber at 220° F.

Re-Beaming

The pieces were sewn together and rebeamed to permit proper tentering.

Preliminary Examination

At this point the pieces were examined for uniformity of dyeing.

First or Preliminary Tentering

After drying the pieces were tentered on a frame which was equipped with wet steam jets that released steam upon the fabric at the entering end. The pieces then passed over hot steam coils while being spread to 37 inches in width.

After this preliminary tentering the pieces were passed through a quetsch containing a finishing solution then returned directly to the dryer.

Second Drying

The pieces were again dryed in the same way as the first drying.

Rebeaming

The pieces were again rebeamed then retentered.

Final Tentering

The pieces were finally tentered out to 39″ in width, examined and tubed.

DESCRIPTION OF THE VARIATIONS CREATED IN THE INDIVIDUAL OPERATIONS AND THEIR EFFECTS UPON THE PEBBLE OF THE FINISHED FABRIC

Control Piece—No. 1

Piece No. 1 was one of the control pieces. The method used in processing this piece has been previously described in detail. The pebble of this piece had good elevation and was uniform in general character.

The pebble of all of the other pieces was compared with pieces No. 1 and No. 18 which were used as standards.

The Effects of Low Temperature in Boil-off—Piece No. 2

Piece No. 2 was boiled-off at 175° F. in the first unit instead of 190° F. The procedure in the other boil-off units was the same as that used in boiling off the control pieces. This piece was then processed the same as the control pieces in all of the subsequent operations.

The pebble of this finished piece was slightly lower than the control pieces.

The Effects of Boiling-off with High Warpwise Tension—Piece No. 3

Piece No. 3 was boiled off with high warpwise tension in the first boil-off unit, then was allowed to pass through the other boil-off units in the same manner as the control pieces. It was then processed in the same way as the control pieces in all the subsequent operations.

The pebble of this piece was the lowest in this investigation showing that warpwise tension in boil off is a very important factor, influencing the degree of pebble in rayon crepe fabrics.

The Effects of Boiling-off with Low Warpwise Tension—Piece No. 4

Piece No. 4 was boiled off with comparatively low warpwise tension in the first boil-off unit. The piece was fed into the bath as slack as possible and was allowed to accumulate in the bottom of the tank. The piece was then processed in the other boil-off units and in the subsequent operations in the same way as the control pieces.

The pebble of this piece had practically the same elevation as the control pieces, but its general character was irregular and where the fabric had accumulated in the first boil-off unit there were fold marks.

The Effects of Extreme Scouring After Boil--off—Piece No. 5

Piece No. 5 was boiled-off in the same way as the control pieces then was scoured for three hours at 180° F. in a beck in a bath containing the following ingredients.

$Na_6P_6O_{18}$ (Calgon)—0.3 per cent (on wt. of goods)
Soda Ash—0.5 per cent
$C_{17}H_{33}CO.NH.C_2H_4SO_3Na$ (Igepon)—0.3 per cent

This piece was then processed in the same way as the control pieces in all of the other operations.

This treatment did not affect the pebble of the finished fabric.

The Effects of Not Scouring After Boil-off—Piece No. 6

This piece was boiled off in the same way as the control pieces then directly dyed without scouring. Other than this omission the piece was processed the same as the control pieces in all of the operations.

This omission had no influence on the pebble of the finished fabric.

The Effects of Dyeing in an Extremely Soapy Bath at as Near Boiling as Possible—Piece No. 7

Piece No. 7 was boiled off and scoured in the same way as the control pieces then was dyed in an extremely soapy bath as near to boiling as possible to maintain the bath.

The dye bath contained the following dyes and ingredients:

S.R.A. Blue III—1.2 per cent (on wt. of goods)
Calconese Blue B—0.4
Celliton Yellow 3 GNL—0.05
Niagara Blue G—0.10
Calcomine Blue G—0.03
Chlorantine Fast Yellow 4 G.L.—0.02
Common Salt—4.00
Soap Flakes—2.00

The piece was worked for five hours at 195° F. to insure complete penetration of the dyestuff. In the final rinse 4.3 per cent of 28 per cent acetic acid was added. The piece was then hydro-extracted and finished in the same way as the control pieces.

This treatment had no affect on the pebble of the finished fabric.

The Effects of Dyeing in a Nearly Neutral Bath—Piece No. 8

Piece No. 8 was dyed in as nearly neutral bath as possible. The piece was first boiled off and scoured in the same way as the control pieces, then dyed in a bath containing the following ingredients:

S.R.A. Blue III—0.9 per cent (on wt. of goods)
Calconese Blue B—0.4
Celliton Yellow 3 G.N.L.—0.05
Niagara Blue G—0.1
Calcomine Violet N—0.03
Soap—0.1

The temperature was maintained at 180° F. during dyeing and the piece was kept in the bath for four hours and forty minutes. The piece was rinsed in warm and cold water but was not acidified. It was then processed in the same way as the control pieces in the subsequent operations.

The pebble of the finished fabric was not affected by this treatment.

The Effects of Drying at High Temperatures—Piece No. 9

Piece No. 9 was boiled off, scoured and dyed in the same way as the control pieces then was dried at higher temperatures in the first drying operation. The temperatures maintained in the dryer during the processing of this piece was as follows:

First Chamber—300° F. Second Chamber—230° F.

Following this operation the piece was processed in the same way as the control pieces.

The high temperature in drying did not influence the pebble of the finished fabric.

The Effects of Drying at Low Temperatures—Piece No. 10

Piece No. 10 was boiled off, scoured and dyed in the same way as the control pieces then was dried at lower temperatures in the first drying operation. The temperatures in the dryer during the processing of this piece were as follows:

First Chamber—170° F. Second Chamber—150° F.

The piece was then processed the same as the control pieces. The pebble of this piece was not affected by the lower temperatures in drying.

Note: The dryness of the fabric was judged by the operators and the speed of drying adjusted accordingly.

The Effect of Variations in the Tentering Operation—Pieces 11, 12, 13 and 14

Pieces No. 11, 12, 13 and 14 were all processed in the same way as the control pieces in all of the operations up to the final tentering. At this point they were treated in different ways:

Piece No. 11 was tentered with comparatively high warpwise tension.

Piece No. 12 was tentered with medium warpwise tension.

Piece No. 13 was tentered with comparatively low warpwise tension.

Piece No. 14 was tentered to 37″ in width instead of 39″.

The pebble of the finished pieces was affected slightly by the variations in the tentering operation. The finished pieces were affected as follows:

(1) Piece No. 11, which was tentered with high warpwise tension, had slightly less pebble than the control pieces.

(2) Pieces Nos. 12 and 13, which were tentered with medium and low warpwise tension respectively, had the same amount of pebble as the control pieces.

(3) Piece No. 14, which was tentered to 37″ instead of 39″, in width, had more pebble than the control pieces.

The Effects of Processing on the Button Breaker—Piece No. 15

Piece No. 15 was processed through all the operations in the same way as the control pieces then it was passed through the button breaker.

The button breaker had little effect upon the height of the pebble but it changed the general character of the pebble causing the fabric surface to appear more open and less full.*

The Effects of Calendering—Pieces Nos. 16 and 17

Pieces Nos. 16 and 17 were processed through all of the operations in the same way as the control pieces then they were calendered.

Piece No. 16 was calendered with heavy pressure and piece No. 17 was calendered with light pressure.

The pebble of both of these pieces was much lower than the control pieces. Piece No. 16, which was calendered with heavy pressure, was flatter than Piece No. 17.

Control Piece No. 18

Piece No. 18 was one of the control pieces and was processed the same as Piece No. 1.

* The committee did not consider the hand of any of the pieces in this investigation.

The Base-Combining Capacity of Wool

MILTON HARRIS and HENRY A. RUTHERFORD*

ABSTRACT

It is shown that the failure of wool to reach equilibrium with alkaline solutions under the conditions of titration experiments is due to the reaction of base with the disulfide groups of the cystine. The results indicate that the extent of this reaction can be determined. The data also afford confirmation of the earlier observation that the alkali degradation of the cystine in wool involves the loss of only one sulfur atom from each cystine residue.

The apparent base-combining capacity increases with increasing duration of contact of wool with alkali and with increasing temperature, but the intrinsic base-combining capacity, obtained by making corrections for the dissolved protein and for the base bound by the sulfhydryl groups, becomes constant after approximately two hours. The most consistent data are obtained at a low temperature where, it appears, secondary reactions are greatly inhibited.

Determination of the amount of base absorbed from solutions of various concentrations indicates that a limiting amount of about 0.7 millimole per gram of wool is reached above concentrations of about 0.2 N sodium hydroxide. Because of discrepancies in the data obtained at concentrations greater than 0.3 N, it is suggested that this value be considered for the present as tentative.

I. INTRODUCTION

MANY properties of wool are intimately related to the number of acidic and basic groups which it contains. Because of the stability of wool in acid solutions, few difficulties are encountered in determining the acid-combining capacity, which apparently reaches a maximum of about 0.80 millimoles per gram of wool at about pH 1[1]. In the alkaline region, however, there has been no indication of a maximum base-combining capacity or of a stoichiometric end-point, and as a result very little knowledge concerning the number of acidic groups in wool can be deduced from published titration data.

The results of recent investigations by Crowder and Harris[2] on the nature of the degradation of wool protein in alkaline solutions suggested that the chief difficulty in determining the base-combining capacity arises from the fact that the alkali reacts not only with the free acidic groups, but also with the disulfide groups of the cystine in the protein. It appears that the primary process in the cleavage of alkali by the disulfide linkage consists in a hydrolytic rupture with the formation of a sulfhydryl compound and a sulfenic acid. The latter is unstable in alkaline solution and immediately loses hydrogen sulfide. The general scheme is given in the following equations:

(1) $RCH_2 - S - S - CH_2R + 2NaOH \rightarrow RCH_2SNa + RCH_2SONa + H_2O$.

(2) $RCH_2SONa \rightarrow RCHO + NaHS$.

The sulfhydryl and sulfenic compounds, formed according to equation 1, are both acidic and accordingly, 2 moles of base are taken up in the cleavage of each disulfide group. However, 1 mole is liberated in the breakdown of the sulfenic acid, as shown in equation 2. If the above mechanism is correct, the amount of inorganic sulfide sulfur (NaHS) formed during treatment of wool with a basic solution should be a measure, not only of the number of disulfide groups hydrolyzed, but also of the amount of base taken up by the sulfhydryl group formed in the wool.

The purpose of the present investigation was to study the absorption of base by wool from the viewpoint of the above hypothesis. It was intended that these studies form a background for the investigation of the basic portion of the complete titration curves.

II. EXPERIMENTAL

Materials — It has been demonstrated in this laboratory and elsewhere[3] that the disulfide group of the cystine in wool is readily attacked by light. Since it was necessary to know the number of disulfide groups which were split during the alkali treatment of the wool, considerable care was exercised in choosing suitable samples for these measurements. Obviously, it was particularly desirable to have the bulk of the sulfur in the form of intact disulfide groups.

Two types of materials were used in these experiments: namely, raw wool fibers and a specially prepared wool yarn. The former were divided into three approximately equal sections, which were designated as the root, middle, and tip portions of the fiber. Each portion was purified by extraction with alcohol and ether and finally washed with distilled water. The analyses given in Table 1 show that both the sulfur and cystine contents decrease from the root to the tip of the fiber, but that only in the tip portion has an appreciable amount of the cystine been destroyed.

The yarn was prepared from raw wool, which had been extracted with Stoddard solvent and washed with water. It was further purified as described above. Determination of the total sulfur and cystine contents showed that 97 per cent of the former could be accounted for as cystine

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TABLE 1

The sulfur and cystine contents of the root, middle, and tip portions of wool fibers

Sample	*Total Suplfur* %	*Cystine Found* %	*Cystine* Calculated* %	*Total Sulfur as Cystine Sulfur* %
Root	3.46	12.6	12.9	97
Middle	3.32	11.8	11.9	95
Tip	3.12	9.9	10.4	85

*Calculated from total sulfur assuming that the destruction of each molecule of cystine involves the loss of only one atom of sulfur.

sulfur, thus indicating that very little photochemical deterioration had occurred. The data reported in this work were obtained on root wool or yarn.

Methods—The complete experimental procedure was as follows: Samples of wool weighing approximately 1 g. were dried in an oven at 105° C. After drying, each sample was weighed and treated with 50 ml. of sodium hydroxide solution at 0°-2°C. (air bath) or 22° C. At the end of a given time, the supernatant liquor was poured off. A 5-ml. aliquot was taken for nitrogen analysis, a 20-ml. aliquot for inorganic sulfide sulfur analysis, and a 20-ml. aliquot for volumetric titration with hydrochloric acid, using methyl red as the indicator. In some of the experiments, an excess of a cold solution of 0.1 N hydrochloric acid was immediately added to the residual wool to prevent further degradation of the fibers. The fibers were allowed to remain in the acid for one day and were then washed for four days in running distilled water. Finally, the cystine content of each sample was determined.

Nitrogen was determined by the micro-Kjeldahl method, total sulfur by the oxygen bomb method[4], and cystine by the Sullivan method[5]. In the latter determination, the wool was hydrolyzed with a hydrochloric-formic acid mixture as described by Miller and duVigneaud[6] and the color measured by the method described by Harris and Smith[7].

The inorganic sulfide sulfur was determined by the following procedure: An excess of bromine was immediately added* to the solution. The mixture was allowed to stand for several minutes, then acidified with hydrochloric acid, and finally warmed on a steam bath until free from bromine. The sulfate was precipitated as the barium salt and determined in the usual manner.

The apparent base-combining capacity is the value obtained directly from the measurement of the total amount of sodium hydroxide removed from the solution by the wool. The intrinsic base-combining capacity is the amount of base bound by the free acidic groups of the undegraded wool. To obtain this, two corrections must be introduced. One of these is small but the other will be shown to be very important.

The first correction, which is the less important, results from the conversion of a portion of the original wool into a soluble form during the treatment with alkali. Since methyl red was used as the indicator, the base bound by the dissolved material is neutralized during the titration. In order to correct for this effect and to obtain only the absorption of the insoluble portion of wool, it is necessary to subtract the weight of the soluble fraction from the original weight of the untreated material. The former is readily calculated from the nitrogen in the solution since it has previously been shown[8] that the loss of nitrogen from wool during alkaline treatment is proportional to the loss in weight of the wool.

The second correction is for the base bound by sulfhydryl groups formed in the degradation of the disulfide groups of the cystine according to equations 1 and 2. The amount of base taken up as a result of these reactions is calculated from the inorganic sulfide sulfur which has gone into solution.

III. RESULTS AND DISCUSSIONS

1. *Effect of Sodium Hydroxide on the Cystine in Wool*

The mechanism suggested[2] for the alkali degradation of the cystine in wool involves the loss of only one sulfur atom for each disulfide group. In order to further test this hypothesis, a series of wool samples was treated with a 0.1 N solution of sodium hydroxide for different lengths of time at 0°-2° C. and 22° C., the solutions and wool being handled as previously described. The effect of the treatment on the cystine is shown in Table 2. Good agreement was obtained between the experimentally determined cystine values and those calculated from the loss in sulfur. Appreciable discrepancies occurred only in the experiments in which the wool was severely degraded by prolonged contact with the alkali.

TABLE 2

The degradation of cystine in wool by O.1 N solutions of sodium hydroxide at 0°-2°C. and at 22° C. as a function of time

	0°-2° C.			22° C.		
Time	*Inorganic sulfide sulfur in solution*	*Cystine Calc.**	*Expt.*	*Inorganic sulfide sulfur in solution*	*Cystine Calc.**	*Expt.*
hrs.	*mg./gm. of wool*	%	%	*mg./gm. of wool*	%	%
0	—	—	12.1	—	—	12.3
0.5	0.44	11.8	11.8	1.10	11.5	11.9
1.0	.46	11.8	11.9	1.49	11.2	11.3
1.5	.50	11.7	11.5	2.21	10.6	10.9
2	.62	11.6	11.6	2.70	10.2	9.9
3.25	.71	11.6	11.5	3.80	9.4	9.1
5	.82	11.5	11.4	5.02	8.5	8.9
6.5	.98	11.4	11.2	—	—	—
8	1.14	11.2	11.3	6.18	7.7	7.7
20	2.27	10.4	10.2	9.34	5.3	6.1
48	3.85	9.2	9.0	12.12	3.2	5.0
90	6.02	7.6	8.1	14.00	1.8	4.2
240	9.36	5.1	6.3	—	—	—

*These values were calculated on the basis that each atom of inorganic sulfide sulfur found in solution represented the destruction of a molecule of cystine.

*Sulfur in wool or in cystine is not oxidized to sulfate under these conditions.

TABLE 3

The absorption of base from 0.1 N solutions of sodium hydroxide at 0°-2° C. as a function of time

Time	1 *Nitrogen in soln.*	2 *Inorganic sulfide sulfur in soln.*	3 *Apparent base-combining capacity*	4 *Base-combining capacity corrected for dissolved protein*	5 *Base bound by sulfhydryl groups formed according to eqs. 1 and 2*	6 *Intrinsic base-combining capacity (4-5)*
hrs.	*mg/gm**	*mg/gm*	*millimols/gm*	*millimols/gm*	*millimols/gm*	*millimols/gm*
0.50	.52	.44	.50	.50	.014	.49
0.75	.54	.40	.56	.56	.013	.55
1.00	.71	.46	.57	.57	.014	.56
1.5	.93	.50	.58	.58	.016	.56
2	.92	.62	.58	.58	.019	.56
3.25	1.20	.71	.59	.59	.022	.57
5	1.42	.82	.60	.61	.026	.58
6.5	1.56	.98	.60	.61	.031	.58
8	1.94	1.14	.61	.62	.036	.58
20	2.61	2.27	.63	.64	.071	.57
48	3.70	3.85	.68	.70	.120	.58
90	4.57	6.02	.72	.74	.188	.55
240	5.47	9.36	.85	.88	.293	.59

*All values in these tables are in terms of grams of dry wool.

TABLE 4

The absorption of base by wool from 0.1 N solutions of sodium hydroxide at 22° C. as a function of time

Time	1 *Nitrogen in soln.*	2 *Inorganic sulfide sulfur in soln.*	3 *Apparent base-combining-capacity*	4 *Base-combining capacity corrected for dissolved protein*	5 *Base bound by sulfhydryl groups formed according to eqs. 1 and 2*	6 *Intrinsic base-combining capacity (4-5)*
hrs.	*mg/gm**	*mg/gm*	*millimols/gm*	*millimols/gm*	*millimols/gm*	*millimols/gm*
5	1.05	1.10	.54	.54	.034	.51
1.0	1.86	1.49	.61	.62	.047	.57
1.5	2.31	2.21	.59	.60	.069	.53
2.0	2.91	2.70	.61	.62	.084	.54
3.25	3.66	3.80	.63	.65	.119	.53
5	4.18	5.02	.64	.66	.157	.50
8	4.73	6.18	.70	.72	.193	.53
20	6.43	9.34	.74	.77	.293	.48
48	7.00	12.12	.80	.84	.378	.46
90	10.5	14.00	.94	1.00	.438	.56

*All values in these tables are in terms of grams of dry wool.

2. The Absorption of Alkali as a Function of Time

The time necessary to attain equilibrium was determined by measuring the absorption of base from 0.1 N solution of sodium hydroxide. The data given in Tables 3 and 4 were obtained at 0°-2° C. and 22° C., respectively.

Figure 1 shows that at 0°-2° C. the apparent base-combining capacity increased with increasing time of treatment whereas the intrinsic base-combining capacity became constant after about two hours. The former arose, as shown in column 5 of Table 3, from the combination of the base with sulfhydryl groups which were continuously formed in the degradation of the cystine. The amount of base which reacted in this manner increased with increasing time of treatment. After 240 hours, the correction amounted to 35 per cent of the apparent value. On the other hand, the correction for the dissolved protein was negligible up to 5 hours and amounted to only 0.03 millimole per gram of wool after 240 hours. The constancy of the corrected values is shown in column 6, and indicates the absence of appreciable secondary reactions.

The intrinsic base-combining capacities obtained at 22° C., as shown in Table 4, appear to be somewhat lower and considerably more erratic than those obtained at 0°-2° C. This may be attributed to several factors. The rate of degradation as indicated by the amount of dissolved nitrogen (column 1, Tables 3 and 4) was much greater at the higher temperature; for example, approximately the same amount of degradation occurred in 3¼ hours at 22° C. as occurred in 48 hours at 0°-2° C. It was also noticed that the reproducibility of the titrations decreased as the amount of degradation increased. The chief difficulty appeared to result from the effect of the dissolved protein on the sharpness of the end-point. Finally, an error was introduced since some sulfhydryl groups were probably present in the dissolved protein. The base bound by these groups was neutralized on addition of acid, and since the

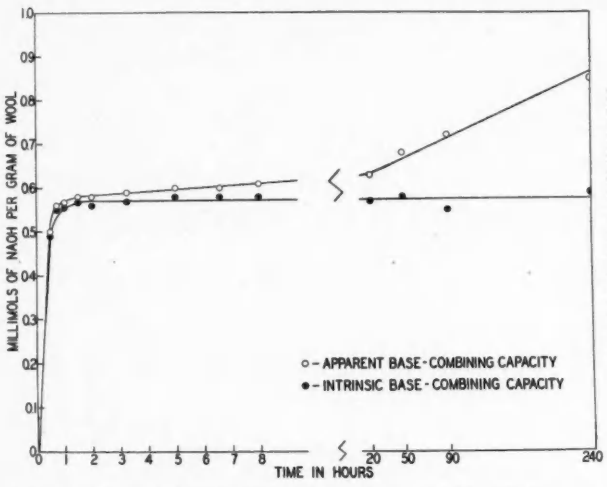

Fig. 1—Rate of Absorption of Base from 0.1 N Solutions of Sodium Hydroxide at 0°—2° C.

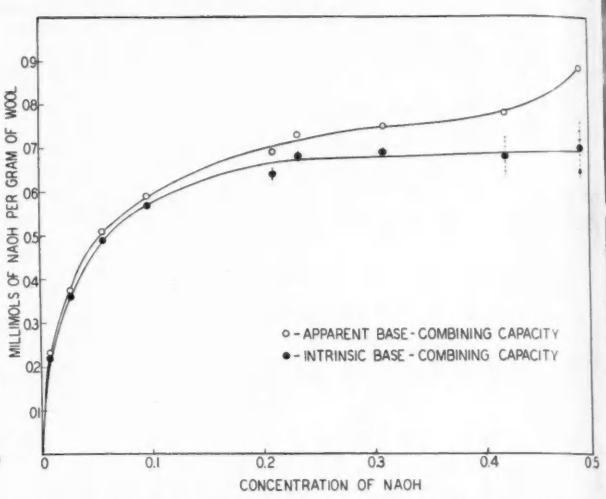
MILLIMOLS OF NAOH PER GRAM OF WOOL
CONCENTRATION OF NAOH
o - APPARENT BASE-COMBINING CAPACITY
• - INTRINSIC BASE-COMBINING CAPACITY

Fig. 2—Absorption of Base from Solutions of Various Concentrations. The broken vertical lines indicate the maximum variations in the values obtained.

data in column 5 were calculated on the assumption that all of the sulfhydryl groups formed according to equations 1 and 2 bind base, these values may be too large. In the case of the low-temperature experiments, and especially for the shorter periods of time, this error is shown to be negligible (Table 3). However, at 22° C. the amount of protein which goes into solution may contain a sufficient number of sulfhydryl groups to account for a large portion of the discrepancy between the values obtained at this temperature and those obtained at 0°-2° C.

3. Absorption of Base from Solutions of Various Concentrations

The effect of varying the concentration of base is shown in Figure 2. The absorptions were measured at 0°-2° C., 2 hours being allowed to attain equilibrium. That equilibrium was reached under these conditions in the most dilute and most concentrated solutions used was indicated by measurements made after 2 and 20 hours.

Each point represents the average of four determinations. Good agreement between the individual determinations for each concentration of alkali up to about 0.3 N was obtained. Above that concentration, there was considerable variation as indicated by the dotted lines perpendicular to the lower curve, which show the spread of the values obtained. The discrepancies may have resulted from secondary reactions which occurred in the strongly alkaline solutions or from the small temperature variations in the air bath used in this work.

The amount of base combined changes very little when the concentration of base exceeds 0.2 N and appears to approach a limiting value of about 0.70 millimole or base per gram of wool.

IV. CONCLUSIONS

The results of the present study show that the failure of wool* to reach equilibrium with alkaline solutions under the conditions of titration experiments is due to the reaction of base with disulfide groups of the cystine. It is demonstrated that the extent of this reaction can be determined.

The data afford confirmation of the earlier observation[2] that the alkali degradation of the cystine in wool involves the loss of only one sulfur atom from each cystine molecule. The remaining sulfur is apparently present in the form of sulfhydryl groups. On the basis of this mechanism it is possible to calculate the amount of base taken up in the degradation of the disulfide groups.

The apparent base-combining capacity increases with increasing duration of contact of wool with alkali and with increasing temperature of the alkaline solutions, but the intrinsic base-combining capacity, obtained by making corrections for the dissolved protein and for the base bound by the sulfhydryl groups, becomes constant after approximately two hours. The results show that the more consistent data are obtained at the lower temperature where, it appears, secondary reactions are greatly inhibited.

Determination of the amount of base absorbed from solutions of various concentrations indicates that a limiting amount of about 0.7 millimole per gram of wool is reached above concentrations of about 0.2 N sodium hydroxide. Since some discrepancies occur in the data obtained at high concentrations of alkali, and since the possible influence of the naturally-occurring ash have not been considered, it is suggested that this value be considered for the present as tentative.*

*This demonstrably applies to other cystine-containing proteins.

*Further work, in which experiments are being made in a water thermostat which can be regulated to 0.02° C, is now in progress. The effect of the ash is also being studied. For these reasons, a discussion of the stoichiometry of the reaction of base with the free acidic groups in wool is not presented at this time.

V. REFERENCES

[1] J. Research NBS *19*, 81 (1937) RP 1012
J. Soc. Dyers Colorists *40*, 408 (1924).

Ber. deut. chem. Ges. *53*, 2164 (1920)
J. prakt. Chem. *137*, 179 (1933)
[2]J. Research NBS *16*, 479 (1936) RP 885
[3]J. Research NBS *17*, 97 (1936) RP 904
Trans. Faraday Soc. *33*, 844 (1937)
J. Research NBS *20*, 563 (1938) RP 1091
[4]J. Research NBS *13*, 617 (1934) RP 721
[5]Public Health Reports *86* (1930)
[6]J. Biol. Chem. *118*, 101 (1937)
[7]J. Research NBS *18*, 623 (1937) RP 998
[8]J. Research NBS *15*, 63, (1935) RP 810.

Determination of Active Ingredients and Fatty Matter in Surface-Active Agents*

RALPH HART**

THE discovery that a sulfo group on a primary carbon of an aliphatic chain of the proper molecular weight, which may or may not be condensed with an aryl group, produces compounds that possess sudsing and scouring properties has led to a flood of patents on synthetic detergents. A good many such compounds are now on the market and their applications in the industries are already extensive and increasing. The synthetic surface-active agents are preferred to soap in numerous industrial operations, particularly in those processes where hard water is used or where the alkalinity due to the hydrolysis of soap is objectionable. Practically all the products available commercially contain considerable quantities of Glauber's salt, because of the process of manufacture or admixture where the product is marketed in the form of a powder. They are usually sold on an "as is" or performance basis, hardly ever on their content of active ingredients. No reliable method for estimating the effective ingredients in such products seems to have been described in the literature.

A method is here outlined for the determination of active ingredients in true sulfonic compounds and in sulfuric acid esters. It is applicable to such products as the sulfated fatty alcohols, sulfonated fatty acid amides or esters, sulfonated alkyl naphthalenes, sulfonated mineral oils, etc., and to the older type of sulfonated oils, such as sulfated castor or olive oil, sulfated oleic acid, sulfated tallow, etc. In the case of the latter type, the trade is accustomed to evaluate a given product by its content of fatty matter. The new method does not determine the fatty matter directly but it may readily be calculated from the active ingredients. The new method is not so convenient nor rapid, but the results are believed to be more accurate than those obtained by the usual method of acid hydrolysis and extraction; the fatty matter during hydrolysis may undergo various changes, such as loss of glycerol, formation of lactones and lactides, polymerization, re-esterification, etc., all of which affect the final weight of the fatty matter in both directions, the net effect depending upon the conditions of the hydrolysis and the nature of the sample. The new method consists essentially of extracting the active ingredients with solvents over a concentrated salt solution, evaporating the solvent, heating the residue to constant weight, and determining the loss in weight upon ashing the residue.

PROCEDURE

Residue Before Ashing. The combined solvent layers from the determination of organically combined sulfuric anhydride by the ammonia method* are transferred to a tared 150-ml. beaker. The solvent is evaporated and the residue heated at 150° to 110° C. to constant weight.

In the case of sulfuric acid esters it is necessary to stabilize the oil with alkali before heating; otherwise the residue turns black because of decomposition. For ordinary sulfated oils, the addition of 2 ml. of 0.5 N alcoholic potash is sufficient to effect stabilization; with highly sulfated oils, double that quantity is required. The first sign of decomposition is when the residue begins to turn red, owing to the effect of the liberated sulfuric acid on the methyl orange present in the oil. With sulfonic compounds the use of alkali is not required.

A more rapid means of reaching constant weight is to heat the beaker, after practically all the solvent has been evaporated on a steam bath, in an oil bath at 135° C. with stirring for 15- to 20-minute periods. In that event the beaker should be provided with a tared glass rod. If the residue is very viscous or solid, an amount of oleic acid (previously heated for 10 minutes at 150° C.) approximately equal to the weight of the residue is added. This serves to liquefy the residue and hasten evaporation of the solvent.

Residue After Ashing. The residue is quantitatively transferred to a tared crucible, preferably platinum. Traces of the residue in the beaker are wiped clean with ashless filter paper moistened with solvents and finally with hot water, and the several pieces of filter paper are added to the crucible. The contents of the crucible are burned off and finally ignited until practically all the carbon is consumed; if necessary, the residue may be treated several times with small quantities of 30 per cent hydrogen peroxide. The ash is then treated with 2 ml. of concentrated sulfuric acid, the acid is evaporated, and the residue is ignited strongly until the weight is constant, preferably with a blast burner.

*Jan. 15, 1939, Analytical Edition, Journal of Industrial and Engineering Chemistry.

**Hart Products Corp.

Total Active Ingredients. The difference in weight before and after ashing represents the loss of organic matter plus sulfur trioxide in the case of ester compounds or sulfur dioxide in the case of sulfonic compounds, in accordance with the following reactions:

$$\underset{\text{Active ingredients: ester compounds}}{2ROSO_3Na} = Na_2SO_4 + \underset{\text{Loss upon ignition}}{(SO_3 + CO_2, \text{ etc.})}$$

$$\underset{\text{Active ingredients: sulfonic compounds}}{2RSO_3Na} = Na_2SO_4 + \underset{\text{Loss upon ignition}}{(SO_3 + CO_2, \text{ etc.})}$$

Sulfuric acid is added to the ash in order to convert into sulfates the sulfides and sulfites which are formed upon ignition. The above reactions show that the total active ingredients for both types of compounds, represented by the right-hand side of the equations, are equal to the "loss upon ignition" plus one-half of the combined sulfuric anhydride as sodium sulfate. Hence, the total active ingredients may be calculated from the combined sulfuric anhydride and "loss upon ignition" (corrected as shown below) as follows:

1. Total active ingredients, per cent

$$= \frac{100 \times \text{loss upon ignition (corrected)}}{\text{weight of sample}} + \frac{Na_2SO_4}{2SO_3} \times \%\ \text{combined } SO_3$$

$$= 0.8875 \times \%\ \text{combined } SO_3 + 100 \times \frac{\text{loss upon ignition (corrected)}}{\text{weight of sample}}$$

Where alcoholic potassium hydroxide had been added, the loss in weight upon ignition is too high by an amount equal to (K — H) and too low by the corresponding amount of potassium sulfate. The corrections for these two items are made as follows:

$$\text{Correction for (K — H), in grams} = -\left[\frac{(K - H)}{KOH} \times \frac{\text{mg. of KOH added}}{1{,}000}\right]$$

$$= -(0.0006774 \times \text{mg. of KOH added})$$

$$\text{Correction for } K_2SO_4\text{, in grams} = \frac{K_2SO_4}{2KOH} \times \frac{\text{mg. of KOH added}}{1.000}$$

$$= 0.001552 \times \text{mg. of KOH added}$$

$$\text{Total correction, grams} = -0.0006774 \times \text{mg. of KOH added} + 0.001552 \times \text{mg. of KOH added}$$

$$= +0.0008746 \times \text{mg. of KOH added}$$

TOTAL FATTY MATTER

In calculating the fatty matter from the active ingredients in samples of sulfuric acid esters, it may be assumed that the latter upon hydrolysis yield a hydroxy group for every combined sulfuric anhydride split off, as follows:

$$\underset{\text{Active ingredients}}{ROSO_3Na} + H_2O = \underset{\text{Fatty matter}}{ROH} + NaHSO_4$$

Hence

$$\underset{\text{Fatty matter}}{ROH} = \underset{\text{Active ingredients}}{ROSO_3Na} - NaSO_3' + H$$

Consequently the fatty matter is given by the following formula:

2. Fatty matter, per cent

$$= \%\ \text{active ingredients} - \frac{(NaSO_3' - H)}{SO_3} \times \%\ \text{combined } SO_3$$

TABLE I
Total Fatty Matter and Total Active Ingredients in Sulfuric Acid Esters

	Total Fatty Matter						*Total Active Ingredients,*		
	New Method			*Acid-Decompostion Method*			*New Method*		
	I %	*II* %	*Av.* %	*I* %	*II* %	*Av.* %	*I* %	*II* %	*Av.* %
Sulfated oleic acid	61.6	61.8	61.7	61.5	61.4	61.5	66.5	66.8	66.7
Sulfated castor oil	60.6	60.3	60.5	60.9	60.5	60.7	65.6	65.3	65.5
Sulfated tallow	83.4	83.1	83.3	82.9	83.0	83.0	86.6	86.3	86.5
Sulfated blended oil[1]	76.9	76.8	76.9	76.4	76.7	76.6	80.3	80.2	80.3
Highly sulfated castor oil	31.7	31.3	31.5	31.6	31.4	31.5	40.2	39.8	40.0
Sulfated fatty alcohol[2]	23.5	23.6	23.6	23.5	23.8	23.7	31.4	31.5	31.5

[1]Used in spinning rayon.
[2]Oleyl and cetyl alcohols.

TABLE II
Loss Upon Ignition of Purified Samples of Sulfonic Compounds and Total Active Ingredients

	Loss Upon Ignition, Purified Sample		*Total Active Ingredients, Sample "As Is," New Method*		
	New Method	*Direct Ignition*			
	Av. %	*Av.* %	*I* %	*II* %	*Av.* %
Fatty acid amide sodium sulfonate	85.8	85.0	27.6	27.3	27.5
Alkyl naphthalene sodium sulfonate	78.4	78.7	64.9	64.6	64.8
Alkyl aryl sodium sulfonate	80.2	79.9	34.6	34.8	34.7

$$= \% \text{ active ingredients} - 1.275 \times \% \text{ combined } SO_3$$

$$= 100 \times \frac{\text{loss upon ignition (corrected)}}{\text{weight of sample}} - 0.3875 \times \% \text{ combined } SO_3$$

From the last formula, it will be noted that an error of 1 per cent in the combined sulfur trioxide determination will affect the fatty matter by less than 0.4 per cent.

EXPERIMENTAL

Sulfuric Acid Esters. The fatty matter in sulfuric acid esters by the new method compared with the fatty matter obtained by the acid-decomposition method is given in Table I, in which also the total active ingredients are listed.

Sulfonic Acids. A number of different true sulfonic compounds were dissolved in a small quantity of water and acidified with sulfuric acid, and the solutions were evaporated to dryness. The residues were then dissolved in hot alcohol, filtered, and again evaporated to constant weights. A portion of each residue was then extracted according to the new method and the loss in weight upon ashing was determined. This was compared with the loss in weight upon direct ashing of the rest of the residue. The results are given in Table II which also includes the total active ingredients contained in the original samples.

It is evident that in the case of sulfonic compounds the loss of organic matter plus volatile sulfur (upon which the new method for active ingredients depends) may be determined directly by ashing the original sample, provided the moisture in the sample is known and there is no other salt present than sodium sulfate. This is also true of the sulfuric acid esters, but, in addition to the above, it is necessary to know the alkalinity of the sample and whether or not the alkali is sodium or potassium.

SUMMARY

An accurate method for the determination of active ingredients in sulfuric acid esters and sulfonic compounds is outlined. This depends upon extracting the active ingredients, which may be contaminated with sodium sulfate but no other salts, and determining the loss in weight upon ignition. A method is also given for the determination of fatty matter in sulfuric acid esters, provided the organically combined sulfuric anhydride is known.

ACKNOWLEDGMENT

The writer is greatly indebted to Virginia Raison of this laboratory for assistance with the analytical work and to H. W. Elley, associate chemical director of E. I. du Pont de Nemours & Co., Inc., for a sample of 2-naphthalenesulfonic acid.

LITERATURE CITED

*Hart, R., Ind. Eng. Chem., Anal. Ed., *10*, 688 (1938).

MEETING, MID-WEST SECTION

A MEETING of the Mid-West Section was held at the Schroeder Hotel, Milwaukee, Wisconsin, on Saturday, May 6, 1939.

Dinner was served at 7:30 P. M. Eighty-four members and guests were present.

The business meeting was called to order at 8:30 P. M. by Chairman Herman Boxser. The minutes of the previous meeting were read and approved.

Due to the illness of Treasurer Frank Acker, his report was read by Mr. E. A. Johnson.

Mr. Boxser introduced our guests and then gave a report of the meeting of the Sectional Committee after which he turned the meeting over to Mr. James Morrison, Chairman of the Outing Committee.

Mr. Morrison announced first that the salesmen were going to offer a cup to the mill man turning in the best score in the golf tournament at the Outing. The members of the Outing Committee then gave their reports and a vote was taken, the members deciding that Lake Lawn, Delavan, Wis., would be the scene of our next Annual Outing which will be held June 17th.

The meeting was then turned over to Dr. Stericker, who gave us a talk on "The Use of Silicates in Textile Processing."

The meeting was adjourned at 10:00 P.M.

Respectfully submitted,

DAVID A. ANDERSON, *Secretary.*

REPORT, NORTH CAROLINA STATE COLLEGE STUDENT SECTION

THE North Carolina State College Section was recently fortunate in having a talk and demonstration on Calgon by Mr. E. T. Laurin. The Senior and Junior classes, a majority of whom are members of the Chapter, recently accompanied Messrs. Grimshaw, Hayes and Bagley of the faculty to the meeting of the Piedmont Section in Greensboro. This was part of a trip of mill inspection, during which the group visited Burlington Mills, Southern Dyers Inc., and the May Hosiery Co. of Burlington, and the Proximity Print Works of Greensboro, N. C. They inspected also the experimental textile waste disposal plant of the Textile Foundation.

Respectfully submitted,

SEYMOUR SCHANDLER, *Secretary.*

MEETING, SOUTH CENTRAL SECTION

THE Spring Meeting of the South-Central Section was held on Saturday, May 6th, 1939, at the Hotel Farragut, Knoxville, Tennessee.

The principal speaker of the evening was Mr. W. A. Springfellow of the Ciba Company, New York City, who gave a paper pertaining to the control of mildew and fungus growth particularly in the textile industry. Mr. Springfellow was assisted by Mr. Ballman of the Dow Chemical Company.

Mr. Nestor Grotelueschen, Chairman, presided at the meeting, which was attended by fifty members and their guests.

It was decided to hold the Summer Outing at the Lookout Mountain Hotel, Chattanooga, Tennessee, the first week in August.

Mr. Fletcher Kibler of the United Hosiery Mills, Chattanooga, Tennessee, was appointed Chairman of the Outing and Mr. Dan Torrence of the Ciba Company was appointed Secretary. The other committees are to be appointed later by the Chairman.

Respectfully submitted,

W. S. McNab, *Secretary.*

REPORT, LOWELL TEXTILE INSTITUTE STUDENT SECTION

THE section has sponsored two speakers and a moving picture recently. At these meetings all the members of the chemistry course were invited guests. On April 13, Mr. William F. Brosnan of the Farr Alpaca Co. addressed the students on the dyeing and finishing of rayon goods. During the spare hour on April 26, the section sponsored for the entire school moving pictures on lubrication. These pictures were shown through the courtesy of the Socony-Vacuum Oil Company. On May 9, Mr. P. J. Wood spoke on "Planning a Modern Dyehouse for Dyeing Synthetic Fabrics."

Respectfully submitted,

William B. Prescott, *Secretary.*

MEETING, NORTHERN NEW ENGLAND SECTION

A MEETING of the Northern New England Section was held at the Weston Country Club, Weston, Massachusetts, on Friday, May 5, 1939.

There were fifty-eight members present at the dinner and business meeting. A very interesting technical program followed.

At the business meeting the Nominating Committee, comprising of Mr. K. H. Barnard, Chairman, Mr. R. E. Derby and Mr. E. B. Bell submitted their nominations for the various offices of the Section. On a voice vote, the following were elected for the 1939-1940 term:

Mr. Clarence L. Nutting, Chairman; Mr. John N. Dalton, Secretary; Mr. John H. Grady, Treasurer; Mr. Edwin A. Buthmann, Sectional Committee; Mr. M. Phillip Graham, Sectional Committee; Dr. Walter M. Scott, National Councilor; Mr. Kenneth H. Barnard, National Councilor.

The National Councilors were elected for a term beginning in June 1939 and continuing until January 1940. All the other officers were elected for terms starting in June 1939 to June 1940.

The Section gave member George Lindberg a vote of thanks for sponsoring the meeting at the Weston Country Club.

The technical part of the program consisted of a very interesting and informative paper entitled "Bridging the Gulf between Manufacturer and Consumer," by Mr. Ephraim Freedman, Director, Bureau of Standards, R. H. Macy & Company, at the close of which Mr. Freedman answered the many questions and problems presented by the members.

Respectfully submitted,

John N. Dalton, *Secretary.*

MEETING, PIEDMONT SECTION

THE Piedmont Section held its spring meeting at the King Cotton Hotel, Greensboro, N. C., Saturday, April 9th, 1939.

During the morning about forty of the members arranged foursomes of golf.

The afternoon technical session was held at 2:30 P.M. The main body convened in the Florentine Room of the Hotel, where the following papers were read and discussed:

"Control of the Variables in Hosiery Dyeing" by Nestor H. Groteleuschen, Magnet Mills, Inc., Clinton, Tenn.

"Organizing a Dyeing and Finishing Plant for Synthetic Piece Goods" by P. J. Wood, Royce Chemical Co., Carlton Hill, N. J.

A part of the members attended another Technical session held in a separate room in the form of a Round Table discussion for the yarn dyers and finishers on the Problems involved in dyeing cotton yarns. This was under the leadership of Mr. A. F. Beane, Threads Incorporated, Gastonia, N. C. There was also a picture of the Wiscassett Mills Dyehouse of Albemarle, N. C., shown by Mr. William Wolhar. The equipment was explained by T. R. Smith, Superintendent of Dyeing and Finishing at the Wiscassett Mills.

The Banquet was held at 7:30 P.M. in the main ball room. Music was furnished by a local orchestra during the dinner, after which we were addressed by Mr. Robert R. West, President, Riverside and Dan River Mills, Danville, Va. He made a very interesting talk on the science of the technician and the necessity of the cooperation between the technician and the business man.

Mr. R. H. Tuttle of the Marshall Field & Co., Leaksville, N. C., donated a small rug to the section, and the lucky winner was Mr. W. A. Krewson of Mt. Holly, N. C. After Mr. West's address the announcement of the Summer Outing was made, also the date of the Summer Outing of the South Central Section. All Sessions were well attended and two hundred and forty-seven tickets were sold for the banquet.

Respectfully submitted,

J. W. Ivey, *Secretary.*

UNEMPLOYMENT REGISTER

Members of this association, who are without employment, should forward to the secretary a statement as to their qualifications and experience. This information will subsequently appear on these pages with an identifying key number. Employers are also requested to file with the secretary or the American Dyestuff Reporter any vacancies which may occur in their businesses.—H. C. Chapin, Secretary, Lowell Textile Institute, Lowell, Mass.

Key: A—Laboratory and research; B—Dyeing or printing; C—Finishing; D—Sales; E—Instruction; F—Executive.

NOTE: PERSONS WHO HAVE OBTAINED EMPLOYMENT SHOULD NOTIFY THE SECRETARY OR THE AMERICAN DYESTUFF REPORTER AT ONCE.

IMPORTANT NOTICE
To Prospective Employers

Complete personal histories and employment records of the following applicants are now on file at the office of the American Dyestuff Reporter and with the secretary of the Association. These may be examined by prospective employers or copies will be loaned upon application.

A-B-7

Education—Evening school in textile dyeing and chemistry.

Experience—Dyehouse laboratory for 2 years. Foreman dyer and finisher on hosiery for 9 years. Experience on ribbons also vat dyes on rayon and silk skeins. 2 years assistant to superintendent. Desires position either in demonstrating and sales or dyer; New York Viciniy. Age 33; married.

A-B-8

Education—Graduate Chemist.

Experience—Print superintendent, colorist; eleven years' experience in all types of fabrics, specializing on rayon; 8 years' dyestuff laboratory and demonstrating. Excellent references; age 36; married.

A-B-C-4

Education—Educated abroad.

Experience—Twenty years experience in the textile field as bleacher, dyer, finisher and chemist. 16 years in charge of dyestuff laboratory of large dyeing plant, 4 years as chief chemist with large bleachery. Has tested dyestuffs, and chemicals used in the textile field and has manufactured soaps and textile specialties. Has handled all textile fibers; bleaching, printing, dyeing and finishing same. Has done pigment and lacquer printing, waterproofing and fireproofing. Reason for leaving last position was due to business conditions.

Age 41; married.

A-B-C-6

Education—English Municipal School of Technology; Board of Education, So. Kensington Chemistry Certificates; City & Guilds of London Institute in Bleaching and Dyeing.

Experience—In U. S. A. 22 years as chemist and chief chemist with one of the largest textile plants in the country; expert colorist; long experience with permanent and semi-permanent finishes. Specialist on vats, naphthols and indigosols. Age 50; married.

A-B-C-D-1

Education—Lowell Textile Institute, Bachelor of Textile Chemistry; Lowell Textile Institute (Evenings), 2 years D. C. Electricity; 2 years A. C. Electricity.

Experience—Six years as chemist and assistant dyer with a large organization. Specialized in dyeing, finishing, bleaching and drying of woolens, worsteds, cottons, rayons and unions in the piece. Some sales experience. Desires position as chemist, dyer, finisher, bleacher or sales. Age 30; American citizen; Married.

A-B-C-F-1

Education—Textile institute course; extension work at Brown; executive training with Alexander Hamilton Institute; knowledge of German.

Experience—Dyeing executive in all types of textiles, including stock, yarns, and piece-goods. Thorough knowledge of all classes of dyes and dyestuffs, and their successful practical application in the plant. Wide experience in all types and makes of equipment used in dyeing, bleaching, mercerizing and finishing. Laboratory practice in planning and checking methods and processes, costing and purchasing. Good manager personnel for efficiency and satisfactory results economically obtained. Cotton, rayon and silk, some acetate rayon, and mixed fabrics. Excellent references; in excellent health.

A-B-C-F-2

Education—Lowell Textile Institute, 1911.

Experience—26 years in cotton yarn and piece goods finishing plants; expert on naphthols, vats and other cotton and rayon dyeing; all types of control work and testing; analytical processes; purchasing of dyes and chemicals. Age 46; excellent references; in perfect health; will go anywhere; married.

B-4

Experience—Foreman dyer in charge of ribbon dyeing for 20 years. Experienced on silk, cotton, rayon, acetate yarn. Age 41; will go anywhere.

B-5

Education—High School and Textile School Graduate.

Experience—Twelve years overseer of dyeing on directs, vats, naphthols, sulfur, basic and developed colors. Also experienced bleacher. Age 40; married; references.

B-6

Education—Textile School Graduate.

Experience—Former instructor in chemistry and dyeing. Twelve years' experience as overseer of dyeing of vats, naphthols, developed, indigosols, sulfur and direct colors on piece goods. Age 35; excellent references.

B-C-3

Education—Graduate, Philadelphia Textile School; speaks German fluently.

Experience—Employed at velvet company for 7½ years. Past 2 years working in finishing department on regular, waterproof and crush-resistant finishes (resin finishes). Can take charge of finishing of velvets. Have some piece dyeing experience.

29 years of age; married; will go anywhere.

B-D-1

Education—Received early training in England and attended technical college there.

Experience—Dyeing executive; all types of ladies and men's hosiery and all types of textiles including stock, yarns, piece goods and government uniforms; woolen and worsted suitings; cotton, silk and rayon on yarns, piece goods and mixed fabrics; thorough knowledge of all types of dyes, successful application of same and laboratory work. Fourteen years with one employer; business conditions reason for unemployment.

Age 52; married; English American; sober and reliable. Desires position as dyer or demonstrator and service man for dye company.

F-1

Education—Two years high school; 6 years evening engineering school; 1 year evening textile school; 1 year industrial management; course in accounting.

Experience—Ten years in an executive capacity in full fashioned hosiery manufacturing business. Familiar with entire manufacturing procedure, finishing dept., dyehouse and office. Specialized in finishing dept. and has good eye for color, finish and quality. Had responsibility of all orders going through mill, stock, grey goods and traffic. Five months in New York sales office. Gets along well with people and contact with employees and customers has always been satisfactory. Previous to hosiery experience was in a mechanical business for 17 years.

43 years of age; single, in good health; will go anywhere.

CALENDAR OF COMING EVENTS

Outing, Northern New England Section, Vesper Country Club, Lowell, Mass., June 9, 1939.

* * *

Outing, Rhode Island Section, Pawtucket Golf Club, June 9, 1939.

* * *

Outing, Philadelphia Section, Whitemarsh Country Club, June 9, 1939.

* * *

Council meeting, New York City, 9:30 A.M., June 16, 1939.

Outing, New York Section, North Jersey Country Club, Paterson, New Jersey, June 16, 1939.

* * *

Outing, Mid-West Section, Lake Lawn, Delavan, Wis., June 17, 1939.

* * *

Outing, Piedmont Section, Ocean Forest Hotel, Myrtle Beach, S. C., June 23 and 24, 1939.

* * *

Annual Meeting, Boston, Mass., September 15 and 16.

ANNUAL MEETING AND CONVENTION

● Further details of technical program and entertainment features will be published in coming issues.

General Chairman
CONVENTION COMMITTEE
W. H. ZILLESSEN

Chairman
PUBLICITY COMMITTEE
H. P. SELYA

Headquarters
COPLEY-PLAZA HOTEL

BOSTON, MASSACHUSETTS SEPTEMBER 15 and 16, 1939

TRADE NOTES • NEW PRODUCTS

• CIBA RELEASES

The Society of Chemical Industry in Basle, represented by Ciba Co., Inc., have issued the following circulars, announcing a number of new products and processes.

Direct Catechine 3 R—this is a new easy levelling direct dyestuff, recommended by the manufacturers for the dyeing of cotton in all stages of manufacture, as well as for rayons and mixed fabrics of rayon and cotton, where shades of equal tone are obtained. Viscose rayon of unequal affinity is dyed uniformly. Acetate rayon is reserved in light shades. Silk may be dyed from a soap bath. After-treatment with Sapamine KW turns the shade a trifle yellower, but improves the fastness to water. Dyeings are not dischargeable to white. Circular No. 491.

Coprantine Blues G L L and R L L—the Coprantines are a new series of dyestuffs (patent applied for) which dye cotton and rayon from a bath containing soda, Glauber's salt and Coprantine Salt I, yielding dyeings said to have good to very good fastness to light and washing. The two blues are the first members of this series, being recommended by the manufacturers for the dyeing of cotton in all stages of manufacture, as well as viscose rayon. The new products are especially adapted for the dyeing of goods for the upholstery and drapery trade. Viscose of unequal affinity is not improved in levelness, the dyeings are not dischargeable to a pure white, but are still suitable for colored discharges. Circular No. 492.

Chrome Fast Olive R or *Synchromate Olive R* (patent applied for)—a mordant dyestuff for wool, which may be dyed either on a chrome mordant, after chromed or by the one-bath method, using Synchromate Mordant. The dyeings are said to have very good fastness to washing, water, perspiration, decatizing, crabbing and acids. The fastness to fulling and light is said to be rated good to very good. Cotton and rayon effects are reserved and acetate rayon is only slightly tinted. Half-wool unions and mixtures of wool and cut staple are advantageously dyed by the one-bath method, in conjunction with direct dyestuffs which are fast to light and resistant to chroming. The new product is not adapted for vigoreux printing. Circular No. 494.

Brilliant Alizarine Fast Violet 6 R—this is a new homogeneous acid alizarine dyestuff having an especially clear tone. This new dye gives on wool, from a weak acid bath, dyeings said to be of very good fastness to water, perspiration, stoving, carbonization and decatizing, as well as good fastness to washing, light and sea water. Effect threads of cotton, rayons, including acetate, remain white. It is also suited for silk dyeing. In mixed fabrics containing wool, the wool may be dyed from a neutral Glauber's salt bath. It is suited for direct prints on both wool and silk, but the dyeings on either fiber are not dischargeable. Brilliant Alizarine Fast Violet may be used for shading chrome mordant colors. Circular No. 495.

• JOINS ATLANTIC LACQUER

Announcement is made of the appointment of Dr. O. W. Leibiger as technical director of the textile division of the Atlantic Lacquer Mfg. Co., 31 Cordier St., Irvington, N. J. Dr. Leibiger is a graduate of the University of Lyon in France and the University of Erlangen in Bavaria and has been connected with the dyestuff and textile industry for 20 years. He has been a pioneer in lacquer printing in the textile field for the past 12 years and his work has carried him through the principal textile countries of Europe and Asia. At different times he has been connected with United Piece Dye Works, Lyons Piece Dye Works and Textile Dyeing and Printing Co. at which place he installed lacquer printing. It is stated that his latest work has been the development of vat colors in a lacquer and printing without washing or steaming for cotton, silk and synthetic fibers with the same fastness to light and similar fastness to washing as regular prints. This company states that it is in a position to furnish overprint, delusters, stencil, screen, coating and stiffening lacquers.

• TEXTILE RECORDER EXHIBITION

Announcement is made by the *Textile Recorder*, British textile trade publication, that it has organized an exhibition of hosiery and knitting machinery to be held in the Granby Halls, Leicester, from October 11th to October 21st of this year. Three quarters of the space have already been let.

• TEXTILE TESTING COURSE

The two week intensified training course in textile testing conducted by the United States Testing Company in the summer of 1938 will be repeated this year. The new course will run from July 10th through the 21st. The course is being repeated because of the number of requests that have been received.

The training will again be limited to 15 individuals. Representatives of the fields of home making, Home Economics, as well as industry and research, interested in textile testing are invited to take the course.

The course will again be under the supervision of G. R. Turner. Test methods and procedures will be taught by experienced technicians of the Company. Theory and practice in demonstration and use of standard testing equipment will be the basis of instruction. The testing of woven and knit fabrics for such factors as construction; fiber identification; tensile strength; seam slippage; color fastness to light, washing and dry-cleaning will be included. Analysis and testing of floor coverings, shoes, furs and clothing will be part of the program. The students will be acquainted with A. S. T. M.; United States Government; Army; Navy and other standards.

The course undertaken as an experiment by the United States Testing Company last year proved of such great interest, it will probably become a regular institution of the Company.

• MONSANTO ACQUIRES RESINOX

Acquisition of Resinox Corporation, third largest manufacturer of phenolic plastics molding compounds, was announced recently by Monsanto Chemical Company.

Resinox, with general offices in the Whitehall Building, New York City, and manufacturing plant and research laboratories at Edgewater, New Jersey, was owned jointly by Commercial Solvents Corporation and the Corn Products Refining Company. The financial details of the transaction were not divulged. All Resinox personnel is being retained.

Monsanto's acquisition of Resinox is its second major move in the plastics industry in thirteen months. On April 1, 1938, the Fiberloid Corporation, Springfield, Mass., pioneer maker of plastics, became the Plastics Division of Monsanto.

• APPOINTED GENERAL MANAGER

Willard H. Cobb, for the past several years general factory manager, mechanical goods plants, United States Rubber Co., has been appointed general manager of the Mechanical Goods and General Products divisions. This position includes supervision of the manufacture of Lastex yarn and rubber thread.

• AIR MOTORED MIXER CATALOG

A 4-page 8½ x 11 folder cataloguing its complete line of air motored agitators, both direct and gear driven, has just been published by the Pneumix Division of Eclipse Air Brush Co., Inc., 398 Park Ave., Newark, N. J. Safety features and variable speeds are set forth together with illustrations of actual installations of these mixers.

• TEXTILE RESEARCH, APRIL

"Properties of Gelatins and Glues and Their Relation to Warp Sizing," by Dr. W. E. Yelland, as published in the April issue of *Textile Research,* is the fifth of a series of progress reports of the warp sizing research that was conducted under the auspices of U. S. Institute for Textile Research at Massachusetts Institute of Technology and completed last Fall. That research was concerned mainly with the sizing of filament rayon warps. An extension of the study is now being organized to cover cotton and spun rayon warps.

"Technical Evaluation of Textile Finishing Treatments," by Prof. E. R. Schwarz, is the first of a series of progress reports of the co-operative research on this subject sponsored jointly by Massachusetts Institute of Technology and the American Association of Textile Chemists and Colorists. This report summarizes the scope of the work, discusses specifically the subject of fabric stiffness, and includes a preliminary but extensive bibliography.

• SCHOELLKOPF MEDAL AWARD

The Western New York Section of the American Chemical Society has announced the award of the Jacob F. Schoellkopf Medal for 1939 to Charles F. Vaughn of the Mathieson Alkali Works. An outstanding man in the alkali and chlorine industry, Mr. Vaughn's work in the graphitization of carbon, his successful development and operation of the Castner mercury cell, and his unqualified ability as an executive and administrator place him in the front rank of those who have made lasting contributions to the chemical industry.

One of Mr. Vaughn's earliest accomplishments was the first industrial application of the graphitization of carbon electrodes, carried out for the Mathieson Alkali Works at Saltville, Va., in 1897. Mr. Vaughn's major contribution to the chemical industry is in the development of the Castner cell for chlorine and alkali production, and as a pioneer in the manufacture of liquid chlorine. The work begun at Saltville was followed by further accomplishments at Niagara Falls.

During the World War, Mr. Vaughn's position as an outstanding authority on the peacetime production of chlorine was recognized by the Government and he was commissioned as a major in the Chemical Warfare Service. He designed a liquid chlorine plant at Edgewood Arsenal which became, at that time, the largest chlorine plant in this country. He was given complete charge of chlorine operations at Edgewood and before the close of the war was advanced to the rank of lieutenant-colonel.

• JOINS ARNOLD, HOFFMAN

Arnold, Hoffman & Co., Inc., has recently added Philip Lavoie to their staff as technical demonstrator of their various sizing, printing and finishing specialties. Mr. Lavoie is exceptionally well fitted to act in this capacity due to the following experience:— 1906 to 1927—superintendent of all finishing departments for Mount Hope Finishing Co.; 1928-32—plant manager for Imperial Printing and Finishing Co.; 1933-34—U. S. Finishing Co. contact man for all plants with the New York trade on viscose and acetate rayon and cotton printing; 1934-36—general plant superintendent of Lincoln Bleachery and Dye Works; 1936-39—demonstrator and salesman on wool finishing and scouring for Arkansas Co.

Mr. Lavoie will make his headquarters in the Providence office of Arnold, Hoffman & Co., and will travel throughout the south.

• GENERAL RELEASE

General Dyestuff Corp., 435 Hudson St., New York, N. Y., announces release of a circular describing the following product:

Chrome Fast Yellow GD—This product, like the previously released Chrome Fast Yellow 5GD, is recommended by the manufacturers for direct prints and for color discharges on vegetable, animal and artificial fibers as well as on mixed fabrics. The shade is redder than the 5GD and is said to possess good fastness to light and washing. It is stated that by using an addition of Dissolving Salt C a good fixation is obtained in the rapid ageing time of eight minutes. Circular No. 1585.

• VISITING EUROPEAN TEXTILE CENTERS

Mr. Ernest Nathan, president of the Warwick Chemical Company of West Warwick, Rhode Island, and Dr. Dale S. Chamberlin, vice-president, and their wives sailed on the S.S. Manhattan, Wednesday, May 3rd, for Europe.

They intend to visit the leading textile centers in England, France and Switzerland and consult with the laboratories of the Warwick affiliates in Paris and Zurich.

They expect to be gone for two months.

• SAFETY SIPHON

The T. P. C. Safety Siphon, described as an extremely safe, simple and efficient device for discharging the contents of carboys, drums and barrels, is now being distributed nationally by the Pulmosan Equipment Corp., 180 Johnson St., Brooklyn, N. Y.

The T. P. C. Safety Siphon consists of a special acid-resistant tube, to which is attached a priming bulb, visual priming chamber, special composition flexible hose and a flow control valve. Once the Siphon

T. P. C. Safety Siphon

is inserted, the flow valve is closed and the priming bulb flexed until liquid shows in the chamber. By adjusting the control valve, a regulated flow of liquid, from a trickle to 6 gallons per minute, may be delivered. Flow is automatic.

Only one man is required to operate the T. P. C. Safety Siphon. It works on the vacuum principle, eliminating the pressure method condemned by the Manufacturing Chemists' Association. It is said to minimize dangers of fumes, burns, spilling and splashing, and to discharge completely without tilting the container. Models are available for every type of acid and container. Descriptive literature and prices may be obtained by addressing the manufacturer above.

• MARTIN JOINS ARIDYE

John C. Martin has left the Ware Shoals Manufacturing Company to join the Aridye Corporation, Fair Lawn, N. J., as sales representative for New England. Mr. Martin was manager of the finishing department of Ware Shoals. Prior to that, he was associated with the Hartsville Print and Dye Works, the Pontiac Finishing Plant, and the U. S. Finishing Company.

• PHOENIX RELEASES

Phoenix Color and Chemical Co., Inc., 24 Van Houten Street, Paterson, N. J., announces release of the following new dyestuff:

Phenacyl Developed Black GGN—This is a greenish shade of acetate rayon developed black which, like Phenacyl Developed Black Conc., is said to be exceptionally fast to crocking, to exhaust well at low temperature and to be satisfactory for jig work. For the production of "jet" blacks the manufacturers recommend its use in conjunction with Phenacyl Developed Black Conc. It is stated that as a self shade it produces the greenish "aniline" black shade whcih many of the jig dyers seem to prefer. It is claimed that it is definitely less bronzy and penetrates better

than the average "jet" blacks which are available for box work. It resembles the rest of this line in its dispersing properties and it is said that it can be boiled freely with live steam without the least danger of specking.

• JOINS CAMPBELL CO.

Announcement is made of the appointment of John Bothamley as southern representative of John Campbell & Co., Inc. He will cover the entire south for this organization and will make his headquarters in Atlanta, Ga. Mr. Bothamley is well known to the textile wet processing industry as he was southern manager of H. A. Metz & Co. for thirteen years and was also connected with A. Klipstein & Co. as southern sales representative. He has also had considerable practical mill

experience. He was born in England and served a long apprenticeship in the dyeing and finishing plants in that country. He filled a position as superintendent of bleaching and finishing at Horwick Vale, England, and then came to the Dominion Textile Company in Canada. He later became superintendent of bleaching and finishing at the New York Mills of Utica, following which he joined the Metz organization. His spare time is devoted to golf and he is classed among the best at his club.

• ZELAN LICENSEES

The Fine Chemicals Division of the du Pont Company announces that the following companies are prepared to finish fabrics with the "Zelan" repellent finish and are authorized to employ the identifying trade-mark: The Apponaug Company, Joseph Bancroft & Sons Company, Bellman Brook Bleachery, Bradford Dyeing Association, Fairforest Finishing Company, Hellwig Silk Dyeing Company, National Dyeing & Printing Company, Sayles Finishing Plants, Inc., Union Bleachery, and United States Finishing Company.

To date, most of the fabric treated with "Zelan" have been consumed by the rainwear and sportswear trades. Volume in these fields is increasing rapidly and "Zelan" treated merchandise is now available in most of the leading stores in the country. Interest is developing rapidly in ready-to-wear, especially for such fabrics as crepes, chiffons and velvets. First "Zelan" treated dress lines are now making their appearance in the stores and ambitious plans are being formulated by a number of converters and cutters for comprehensive promotions of "Zelan" treated ready-to-wear numbers for Fall.

• GEIGY RELEASES

Geigy Co. Inc., 89 Barclay St., New York City, announces release of circulars describing the following products:

Novazol Acid Blue SL, Novazol Acid Blue GL, Novazol Acid Blue BL—a group of colors said to be distinguished by excellent level dyeing properties, very good fastness to light, and good fastness to carbonizing and water spotting. They dye pure silk approximately to the same depth as wool. This feature makes these colors valuable for dyeing carbonized piece goods made from re-worked stocks that still contain undestroyed silk threads or specks. These brands may be used as self colors or in combination with other fast to light, level dyeing acid colors. These colors are said to be well suited for the dyeing of wool yarn or piece goods for men's and women's wear, carpet yarns and wool hats, as well as for wool-silk combination fabrics. Circular 301-D.

Neutral Yellow RX—a second edition of this card displaying the product on a wide range of fabrics such as: weighted and unweighted silk; woolen piece goods; gloria (wool-silk); union fabrics with thread effects of acetate rayon, viscose rayon and silk; silk and cotton, dyed one-bath and two-bath methods; discharge prints (unweighted silk); and mohair pile fabrics. This color is particularly recommended by the manufacturer for the dyeing of cotton-silk hosiery as well as knitted silk goods. It is stated that it can be used to good advantage for dyeing silk in a boiled-off soap bath. Circular 796.

Polar Yellow 5GN Conc.—a further addition to the range of Polar Colors which possesses the characteristic fastness properties of this series. Compared with the older Polar Yellow 5G Conc. this new brand is brighter and clearer in shade and is said to possess somewhat better wet fastness properties. It is suitable for dyeing wool in all stages of manufacture, weighted and unweighted silk, and combination fabrics of wool and silk. It is said to possess good neutral dyeing properties which make this new color suitable also for shading the animal fibers in union fabrics, the cotton and rayon remaining clean, and for dyeing mohair pile fabrics. Circular 972.

Diphenyl Fast Blue Red R—a new color said to be of good fastness to light and suitable for dyeing cotton and rayons of all descriptions. It is stated that it is particularly suitable for dyeing unions inasmuch as it has equal affinity for wool and cotton. Further, it is said to be suitable for dyeing mixed fabrics of cotton and viscose rayon. It is dischargeable with hydrosulfite and leaves acetate rayon effects clean. Circular 981.

Polar Violet B Conc.—the first violet in this range of colors. It can be applied to wool in all stages of manufacture, weighted and unweighted silk and to gloria (wool and silk). It is stated that it possesses good neutral dyeing properties and can, therefore, be used for covering animal fibers in all types of union materials; cotton fibers are tinted faintly bluish and rayons, including acetate, are left clean. It is suitable for shading chrome dyeings. Circular 975.

Tinogen Dyestuffs—a new group of printing colors which are said to permit the production of direct prints with azo dyestuffs on cotton, viscose and cuprammonium rayons, linen, and mixed fabrics without previous naphthol treatment. The present range, marketed in powder form, comprises orange, scarlet, red and bordeaux brands. The stability of the printing pastes is said to be good. If used by themselves, they are developed according to a new method without steaming. Inasmuch as they can also be steamed, it is stated that fast multicolored effects can be secured when they are used in combination with vat dyestuffs and such chrome colors as may be fixed by short steaming. Application, with suitable equipment, is said to be simple. It is further stated that they can be used on the most delicate fabrics such as viscose crepes, etc., and that the resulting prints are characterized by their good yield, brilliancy and excellent fastness properties. Circular 990.

• REPRESENTING REICHHOLD

On May 1st, Van Waters & Rogers, Inc., Seattle, Wash., became sales agents for the Reichhold Chemicals, Inc., line of synthetic resins in the Pacific Northwest territory, including the states of Washington and Oregon and the Victoria and Vancouver district.

• OPENS FIELD SERVICE OFFICE

Mr. A. J. Wadhams, vice-president of the International Nickel Co., Inc., and manager of the Development and Research Division, has announced the establishment of a new field office located at 67 Wall Street, New York, N. Y.

The new office, which was opened May 1st, is under the direction of Mr. J. W. Sands. Its main function will be to promote the use of nickel alloy steels and

stimulate interest in products of the Huntington Mill, nickel cast irons and the use of nickel in non-ferrous alloys.

The territory covered by this office includes Metropolitan New York, Long Island, New Jersey; Pennsylvania, east of Williamsport, Harrisburg, York; Delaware, Maryland, Virginia, and the District of Columbia.

This is the sixth office opened by the Development and Research Division to give manufacturers in various industrial districts prompt, efficient service in handling their metallurgical problems. Other offices are located in Los Angeles, Calif.; Chicago, Illinois; Detroit, Michigan; Hartford, Conn.; and Pittsburgh, Pa.

• NEW "ORTHOLUX" MICROSCOPE

The accompanying illustration shows the new Leitz "Ortholux," a modern research microscope, which has many new features incorporated in a reversed type of stand. The illumination system, which is built-in, pre-centered and permanently aligned, is said to have a variable intensity sufficient for photomicrography up to the highest magnifications.

Ortholux is designed for both transmitted and reflected illumination and, if desired, has the additional advantage of polarized light.

A new substage, with upper lens mounted on a swing-out arm, eliminates the unscrewing of this lens for low power microscopy. Two aperture diaphragms are provided: one for high magnifications and, for the first time on biological microscopes, one for low magnifications. This substage provides easy synchronization of numerical aperture of condenser with that of any objective.

All controls, including those for the mechanical stage, are conveniently arranged at table level. The binocular body is removable and can be replaced by a monocular tube with side telescope for convenience in photomicrography or for projection of image onto the taple top for counting, measuring, drawing or demonstration purposes. This last feature makes the "Ortholux" especially adaptable for the projection method of wool grading and denier analysis.

Ortholux Microscope

Further information can be obtained from E. Leitz, Inc., 730 Fifth Avenue, New York, N. Y.

• CUSTOM HOUSE GUIDE

The *Custom House Guide* has just issued its 1939 New York World's Fair de luxe annual edition. A new feature outstanding this year has been the inclusion of the exact wording of each of the 19 Reciprocal Trade Agreement rates of duty and other changes brought about by executive or legislative action, under each paragraph affected in the Tariff Act of 1930 Section.

A *Special Acts Affecting Imports Section* has been added showing various acts including import taxes and processing taxes applying to imported merchandise or products derived thereupon.

Other information includes port sections which completely covers the activities and facilities of all principal ports; and a section of general information, including foreign forwarding agents, weights, measures, coin values, trade terms, air services, Federal Alcohol Administration, Department of Agriculture, State Department, Department of Commerce, Bureau of Foreign & Domestic Commerce, Consular Service, Foreign Customs Headquarters and Embassies, alcoholic beverage importers and exporters and much other additional information.

Custom House Guide (77th Year), 1939 edition is published by Custom House Guide, Box 7, Sta. P, Custom House, N. Y. The price is $15.00, plus postage.

• VISIT MILLS

Juniors and Seniors in Textile Chemistry and Dyeing at the Textile School of North Carolina State College attended the sectional meeting of the American Chemists and Colorists at Greensboro, N. C., on April 28 and 29.

In connection with this, the students made an inspection trip to a number of textile plants, including May Hosiery Mills, Burlington; Burlington Dyeing and Finishing Company, Burlington; Proximity Print Works, Greensboro.

The students were accompanied by Professor A. H. Grimshaw, of the Textile Chemistry and Dyeing Department.

• WITH LAVANBURG CO.

W. H. Hasse joined the sales organization of Fred L. Lavanburg Co., Inc., Division of Reichhold Chemicals, Inc., late in April and is contacting the trade in Michigan, northern Indiana and northwestern Ohio.

CLASSIFIED

POSITION WANTED: Plant chemist. Graduate Lowell Textile Institute, 1929. Three years' laboratory and demonstration experience with large dyestuff concern. Six years' experience as chief chemist of dyeing and finishing plant. Also four and one-half years as chemical purchasing agent. Familiar application and testing of all types of textile dyestuffs. More than average ability for trouble-shooting. Age 34. Married. Now employed. Location immaterial. Write Box No. 182, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED: — Chemist-dyestuffs, textile chemicals. Recent graduate Massachusetts Institute of Technology in chemistry, minor-textile chemistry. Further studies in Textile chemistry at Columbia University. Has excellent technical background and three months experience in dye laboratory. Capable assistant for research or for routine laboratory dyeing, testing and color matching. Has knowledge of color spectrophotometry. Needs start to prove capabilities. Location immaterial. Write Box No. 133, West New York, New Jersey.

QUALITY AND PRODUCTION EXECUTIVE FOR FINISHING PLANT: Practical executive with twenty-eight years' experience in both northern and southern plants, practical dyer and finisher, has succeeded in assisting several plants back into profitable operation, seeks connection with plant desirous of modernizing methods and reducing costs. Successful in keeping labor relations on friendly basis. Write Box No. 184, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.